Program Highlights

SIXTH ANNUAL MEETING ENTOMOLOGICAL SOCIETY OF AMERICA

Hotel Utah, Salt Lake City, Utah—December 1 to 4, 1958

By L. D. ANDERSON, *Chairman*, Program Committee

PRELIMINARY REPORT ON SPECIAL FEATURES

GENERAL SESSION

Presidential Address—Robert L. Metcalf
L. O. Howard Memorial Lecture—Carroll Williams
Photo Salon—Leland A. Brown, *Chairman*
Banquet and Program
Entomological Exhibits
Social Mixer

SECTION "A"—GENERAL ENTOMOLOGY

Symposium: "Insect Aggregations" A joint symposium with the American Section of the International Union for the Study of Social Insects. Dr. C. D. Michener, University of Kansas, organizer and moderator.

Symposium: "Hybridization and its Relation to Speciation in Insects." Dr. J. N. Belkin, University of California at Los Angeles organizer and moderator. Includes Drosophila hybridization by M. R. Wheeler, hybridization in taxonomy by L. E. Rozeboom, effect on speciation by R. I. Sailer, hybridization in Lepidoptera by W. Hovanitz, hybrid leafhoppers by H. H. Ross, and hybrid mosquitoes by J. N. Belkin.

Section A, sub-section (a) Teaching

Symposium: "Are Recent Graduates in Entomology Adequately Trained in other Sciences." Philip F. Bonhag, University of California, Berkeley, organizer and moderator. Speakers from the following seven phases of entomology, ecology, physiology, morphology, systematics, toxicology, biological control, and applied entomology.

SECTION "B"—PHYSIOLOGY AND TOXICOLOGY

Submitted papers only

SECTION "C"—BIOLOGY

General session submitted papers only

Section C, sub-section (a) Biological Control

Symposium: "The Future Outlook in Biological Control." C. B. Huffaker organizer and moderator. Symposium will cover foreign introductions, native parasites and predators, insect diseases, integrating natural and chemical control, obstacles to use of biological control, etc.

Section C, sub-section (b) Apiculture

Symposium: "Methods of Testing the Effects of Insecticides on Honey Bees." Frank E. Todd organizing and moderating. Purpose of the symposium is to try to develop and standardize field testing techniques and discuss field results and tell how to best use these results. Also, E.S.A. and American Beekeepers Association coordination will be discussed.

Section C, sub-section (c) Relations of Insects to Plant Diseases

Forum Discussion: R. C. Dickson will plan and moderate a forum discussion period at the close of the last session of submitted papers in this section. Discussion to be based on new or outstanding information given in submitted papers on insect transmission of plant diseases.

Section C, sub-section (d) Ecology and Bionomics

Submitted papers only

SECTION "D"—MEDICAL AND VETERINARY ENTOMOLOGY

Symposium: "Insecticide Resistance of Insects of Medical and Veterinary Importance." A. W. A. Brown organizer and moderator.

Invitational Paper: "Natural Control of Medically Important Insects" by Dale W. Jenkins.

Another symposium on the use of systemic insecticides on man and animals is being considered.

SECTION "E"—CONTROL, EXTENSION, AND REGULATORY ENTOMOLOGY

Invitational Papers by E. D. Burgess and E. P. Reagan.

Section E, sub-section (a) Extension

Probably submitted papers only

Section E, sub-section (b) Plant Pest Control and Quarantine

Probably submitted papers only

SECTION "F"—CONTROL INVESTIGATIONS

Symposium or invitationly speaker program is being prepared on industrial Pest Control.

BRIEFLY

The sixth annual meeting of the Entomological Society of America will be held at the Hotel Utah, Salt Lake City, Utah, December 1 through 4, 1958. Please note the following.

Chairman, Local Arrangement Committee. George F. Knowlton, Utah State University, Logan, Utah.

Chairman, Exhibits Committee. Archie D. Hess, USPHS, P.O. Box 334, Logan, Utah.

Chairman, Committee on Publicity. E. H. Littooy, 100 Gate 5 Road, Sausalito, California.

Chairman, Program Committee. L. D. Anderson, Citrus Experiment Station, Riverside, California.

DEADLINE

The deadline for receipt of titles and abstracts of papers to be presented at Salt Lake City is September 1, 1958. Please send these to L. D. Anderson, Citrus Experiment Station, Riverside, California.

The program of the meeting will be published in the September issue of the BULLETIN. Copies of the program will also be available free to registrants at Salt Lake City.

BRANCH OFFICERS

Please see page 33 of the March 1958 issue of the BULLETIN for a complete listing of the 1958 Branch Officers effective as of that date. The North Central Branch met in St. Louis on March 26–28. Their new officers are as follows:

R. E. Hill, Lincoln, Nebraska ..... *Chairman*
J. W. Apple, Madison, Wisconsin ..... *Chairman-Elect*
C. W. Wingo, Columbia, Missouri ..... *Secretary-Treasurer*

IOWA STATE CENTENNIAL

The centennial of Iowa State College was celebrated March 22–25, 1958. The Entomological Society of America was represented by Paul A. Dahm. Society representation was fitting since Iowa State has long had one of the leading entomology departments. We take this means of extending congratulations to the college through Dr. H. M. Harris and his most capable staff.

Elements of Entomology[1]

FOREWORD

By BENNET A. PORTER

Entomology Research Division, Agricultural Research Service

United States Department of Agriculture, Beltsville, Maryland

After having served as moderator of the Symposium on the Elements of Entomology, I have been asked to prepare a foreword for this group of four papers to be published in the BULLETIN. Having listened to the reading of these papers, and having had the privilege of reading the manuscripts, my contribution could as well be called a postscript.

The Eastern Branch *Program Committee* has done the Branch and Entomology in general a valuable service in arranging for this discussion. Before the meeting plunges into a series of papers dealing with limited segments of our field, including some on tests of this or that chemical against this or that insect pest, it is well that we pause and take a broad look at our field of endeavor as a whole.

It is quite appropriate that the lead-off paper is on "The Man", which Captain Knight refers to as "A pre-eminent factor in Entomology." This is a viewpoint with which we will all agree. We are also agreed that entomologists should all strive for better service and performance, and an improvement in standards and status all around. However, with the wide diversity in the viewpoints of entomologists engaged in the extremely diverse segments of our profession, differences of opinion on the means whereby this recognized goal may be approached are inevitable. Captain Knight is to be commended for tackling this group of knotty problems, and we wish him success in his service as Chairman of the Society's standing *Committee on Professional Training, Standards, and Status.*

[1] Symposium of invitation papers presented at the twenty-ninth annual meeting of the Eastern Branch, Entomological Society of America, New York, N. Y., November 25, 1957.

With all of our preoccupation with chemical and mechanical engineering, or with project statements, budget justifications, and the like, we sometimes overlook the fact that we are dealing with living insects. Dr. Sailer's paper brings us back to the real basis of all of our work. His paper is most timely.

When a man goes into administrative work it is sometimes said that he will be lost to research. And if he moves into a broad enough sphere of action, it is said that he will also be lost to Entomology. A study of Dr. Glen's paper shows the fallacy in such statements. Although a man in such a position may lose the thrill of personal research, he can have the satisfaction of vicarious participation, and may even make greater contributions to the progress of the science and the profession than would be possible if his efforts were directed to actual research along limited lines. I am certain that Dr. Glen is still making outstanding contributions to entomological research and to the well-being of the profession.

The opinions expressed by Dr. Ferguson are strikingly parallel to those expressed by thoughtful entomologists in official positions. His paper brings out the essential unity in our science and profession in spite of numerous differences in immediate, short-range objectives. We are all working towards the same ultimate goals.

The Eastern Branch *Program Committee* has made a most fortunate choice of subjects and speakers for this Symposium. When the papers appear in the BULLETIN I recommend that all members of the Society read and re-read them. These papers contain much valuable food for thought.

Elements of Entomology - The Man

By KENNETH L. KNIGHT[1]

CAPTAIN, MSC, U. S. NAVY

Bureau of Medicine and Surgery

Department of the Navy, Washington, D. C.

The concept of *man* as an *element* of *entomology* never particularly occurred to me until the day it was suggested as a topic for this talk. Even at first appearing to be somewhat alarming in nature, it grew more so by the minute as I mentally circumnavigated the concept. Man's stature seems to shrink away as he faces the gargantuan thought of being out-numbered species-wise by more that 500,000 to one. Yes, man stands alone before an endless array of insects—an array which affects every phase of his existence and which in the end leaves only his skeleton as evidence that he ever existed.

However, man does have a place in the scheme of entomology, I am sure. Here, I am reminded of the Presidential Address of A. F. Burgess given on January 1, 1925 before the American Association of Economic Entomology in which he described the vast network of railroad property of the New York Central—trackage, rolling stock, stations, right-away properties—all worth hundreds of millions, and then quoted the President presiding over all this as once saying "A railroad is 95 per cent man and 5 per cent rust and dust." So, even with a ratio of 500,000 to one, I believe that we can say entomology is 95 per cent man and 5 per cent chitin and hemolymph.

WHERE TO GET MAN.—If the entomologist is such a pre-eminent factor in entomology, have we then not need for looking into his welfare and for nurturing and cherishing him a bit? Personally, I feel that we do have such a need.

However, before looking further into welfare matters, let us briefly consider the problem of where to procure man, the entomologist. Currently, there is a flood of writing expressing concern that the percentage of men and women in our total population taking up the sciences as a lifetime vocation is decreasing and that the percentage of those who do, but go into engineering and the physical sciences as opposed to the biological sciences, is increasing. Reasons

[1] This paper contains excerpts from the Report of the Committee on Professional Training, Standards and Status which coincidentally appears elsewhere in this issue.

for the first situation have been expounded in a recent report published in *Science* (126:384–390, 1957). Secondary school students when questioned on their concepts of a scientist predominately thought of him as a white-coated "egghead" or "longhair" who made great personal sacrifices to become a scientist, as being closeted in laboratories full of weird-looking equipment, as being socially unacceptable, as one who frequently works a lifetime without seeing a successful termination to his work, and even as one who is often in actual personal danger because of his work. Watching the public adulation and recompense accorded to entertainers and athletes makes it clear why young people are further reluctant to take the long road to being scientists. Nor is it helped any by watching financial wizards manipulate themselves to a fortune without the use of any particular academic background, and then to be able to buy the services of an entire laboratory of scientists so that they might further increase their wealth. It is indeed ironical that the material returns of science and modern technology are so exciting and desirable as to encourage young people to elect early full time employment in preference to the long low income period necessary for training to a scientific vocation.

Reasons for the superiority of engineering and physical sciences over the biological sciences in the eyes of our young people are equally apparent when you consider the social acceptance and professional prestige which the conquest of the atom and the development of Sputnik has brought to these disciplines. Furthermore, employment opportunities in these fields are infinite and salaries average considerably higher.

Nonetheless, it is somewhat questionable that we face an acute shortage of entomologists. Past experience indicates that when the demand for personnel has expanded, so likewise has the supply. Perhaps the more pressing problem here is one of quality. Is the vocation of entomology continuing to receive its fair share of the wholly motivated and competent youth of the Nation? If not, what then can be done to correct this situation?

There is much that can be done, but since all of it requires a personal sacrifice of time and effort on the part of each one of us, it will probably be accomplished only to a limited extent and in a decidedly hit and miss manner. Rather than allow this type of a situation to predominate, would it not be better to establish under the auspices of the Entomological Society of America, and of its geographical branches, official programs for the illumination of entomology as a career? In this connection it would be desirable to sponsor such activities as entomology clubs, equivalent in spirit and zeal to the Audubon Society clubs; to provide informal talks and discussion periods to schools, parent teachers associations, and youth organizations; to prepare popular articles for newspapers and magazines; and to develop further our present brochure on career opportunities in entomology.

Further help could be provided by sponsoring the production of a film dealing with entomology as a hobby and a vocation, by the preparation of a traveling exhibit for use in schools, by the establishment of a series of undergraduate national scholarships (*Science* 126:997, 1957. States that each year some 100,000 well-qualified high school graduates are financially unable to get higher education), and by the establishment of apprenticeship and summer employment opportunities in entomology. And of course, anything done to enlarge the status of entomology as a profession will contribute to the election of this specialty by young people seeking a career.

KEEPING MAN THE ENTOMOLOGIST.—Mention was made earlier of the desirability of looking after the welfare of *man*, the entomologist, and this is the subject I would like next to consider.

As our profession has grown, American entomologists have been giving an increasing amount of attention to the problem of professionalism, and particularly to the question of whether or not individuals shouldn't meet specified professional standards in order to be officially considered as entomologists. Much of this concern is undoubtedly motivated by the belief that personal prestige, opportunities, and remuneration will all be advantageously effected. However, in all fairness, it must also be pointed out that many others believe that professional standards will improve the study and practice of entomology. At any rate, interest in this subject lead to the establishment of an Entomological Society of America temporary committee in 1955 and of a permanent *Committee on Professional Training, Standards, and Status* in 1956. This Committee is charged with the responsibility for providing long-range guidance to the Society in matters relating to professional training, standards, and status for entomologists, and to serve as the medium through which needed improvements can be officially undertaken.

In considering where to begin with the problem of professionalism in entomology, it would seem that perhaps the derivation of professional standards should receive first consideration since such an action would be equivalent to developing a definition of a professional entomologist. Following this line of reasoning, the next step would be to give consideration to entomological curricula, since professional standards must inevitably be based, at least in part, on academic training. And last, with the development of appropriate professional standards and of suitable training, an improvement in the professional status of entomology should eventually result. Lest the above statement of approach be interpreted to mean that professionalism can be gained solely through the use of legislative devices, I hasten to add that in the last analysis there is no substitute for exemplary individual conduct, meritorious work, and dedicated service as a route to true professional status. All too often the individual who is most concerned over his lack of acceptance as a professional man is also characterized by having a pile of unread journals and books on his shelves and who puts away all thoughts of entomology at the end of his working day.

Why is there a need for professional standards? Perhaps the purest motive for having them lies in the belief that professional standards will improve the study of entomology as a science and its practice as a profession. From this concept, it is but a step to the belief that such improvement will result in a higher regard by the public and by other professions for entomology and entomologists, which in turn should lead to greater professional opportunity and personal reward.

Granting for the sake of discussion that the establishment of professional standards is desirable, what will be the effect of such a movement on the present Entomological Society of America, keeping in mind the diverse and varied composition of the Society? Can this objective be accomplished without creating a ground swell of dissension that might tend to divide our ranks once again? There is little question but that at all costs the "union must be preserved," and that the road to professional betterment must therefore be traveled with extreme caution.

At the present time many individuals qualify for the title of "entomologist" as defined by the Constitution of the Entomological Society of America but who would no longer so qualify if professional standards requiring specified minimal levels of didactic training were established. All of these individuals can and do make real contributions to entomology. However, whether or not they basically feel or expect full responsibility or recognition as professional entomologists is a point which would have to be determined.

Plans for establishing professional standards will inevitably cause concern on the part of recognized entomologists who lack formal training in the field. Accordingly, any plan developed must contain a "grandfather's clause" which grants fullest privileges to all present members.

It is believed that the first and most practical approach to the development of professional standards is to draft a revision to the Constitution of the Society which would require more than a simple expression of interest in insects for full participation in Society affairs. In this advanced age it would not seem out of line to require all *new* Active Members to have a bachelor's degree from a recognized

institution of higher learning. Since it is now well-accepted that specialization should not begin too early in the training of an individual, it is believed inappropriate to require that this degree be in entomology, just so long as it includes a good fundamental background in the sciences. However, a certain period of experience in the field of entomology should be required to insure that individuals without formal training beyond the baccalaureate level are actually entomologists. At the present time, it is believed adequate to permit holders of the Master's Degree to become new Active Members with a lesser amount of experience than is required of Bachelors, and for Ph. D's to become such without experience, provided these degrees are in entomology. Associate Membership status should be provided for those individuals who qualify in all respects except for possessing the required experience. Upon the completion of the prescribed period of experience, Associate Members would be permitted to request advancement to Active Membership.

In order to retain the active affiliations of specialists from other disciplines, of individuals employed in applied phases of entomology but without professional training in entomology, and of the frequent dedicated individual who contributes to entomology solely from an inborn inquisitive nature, it is recommended that an Affiliate Membership status be established which would require only a certain number of demonstrable years of activity or interest in entomology for eligibility.

Many objections will be raised against any effort to write professional standards into the requirements for membership in the Entomological Society of America. Perhaps the most cogent and least individually-biased criticism of this procedure is the fact that the Entomological Society of America was established and is operated as a "scientific society" and not as a professional organization largely dedicated to the betterment of the welfare of individuals. It is not believed these objectives are mutually exclusive. However, if it develops that there is an overwhelming desire to maintain our organization in its former status, a second and perhaps equally effective approach to the development of professional standards could be through the establishment of a suitable form of "certification" for those segments of the Society where the need is greatest. For example, it is believed that such a need particularly exists in the subspecialty of medical and veterinary entomology, since individuals employed in this field customarily work beside physicians, veterinarians, and public health sanitarians—all members of groups with exacting requirements for practice. Time does not permit the elaboration of specific details for the development of certification for entomology. In general, however, it is conceived that it might be accomplished by a board organized within the framework of the Entomological Society of America and having as its principal function the conferring of professional rating upon successful applicants by means of a certificate indicating the possession of special training and experience.

The Society of American Bacteriologists has just recently established the American Academy of Microbiology to serve as a certifying agency for bacteriologists and related specialists who desire or need concrete evidence of their professional status. It is believed that entomologists can profit immensely by watching the outcome of this venture by a Society which closely resembles the Entomological Society of America in most details. Certification is quite expensive and doubt is felt that sufficient entomologists yet desire such a step sufficiently seriously as to support the additional financial burden which it would bring to them.

Very often new solutions raise as many problems as they answer. And so is the case here. The institution of professional standards, based as they must be largely on specified minimal levels of formal academic training, will require an intensive investigation of entomological training. The subject of the training of a professional entomologist has recently been most appropriately treated by Dr. S. B. Freeborn in the BULLETIN OF THE ENTOMOLOGICAL SOCIETY OF AMERICA (Vol. 2, No. 4:23–24. 1956). From a consideration of Dr. Freeborn's comments and from an examination of the work being done by many other professional organizations in this field, it becomes apparent that a tremendous and highly complicated problem is involved here. Included within this problem is the determination of what minimal training is necessary to make an adequate entomologist at the baccalaureate level, the problem of graduate school requirements, and the problem of the accreditation of institutions providing entomological training. Suffice it to say here, it is felt that there is a real need to determine the desirable minimum of training required of entomological graduates at each degree level, and that a study to accomplish this determination should be set into motion at an early date. The Society of American Foresters have provided an excellent example in this respect. In 1929 they received a Carnegie grant for the conduct of an official study of forestry education. This lead eventually to the production of two books on professional forestry training, which have been instrumental in bringing a great deal of prestige to their program.

Mention has been made during the past twenty minutes of a few of the factors relating to man as an element of entomology. As is perhaps natural, the items discussed represent areas of particular interest to me. Some of the material presented is controversial in nature and quite likely there are many among you with markedly diverse views. This is a healthy situation, and one that is certainly to be encouraged. If a plea is contained here it is simply to urge that all of us spend freely of our time and energies in the betterment of our profession. In closing, I would like to quote a statement from a recent article by Clifford F. Rassweiler, President-Elect of the American Chemical Society on "Marks of the Professional Man," which I believe aptly sums up what I have been trying to say: "True professional status is characterized by the willingness of professional men to work to advance their own profession or science." (*Nat. Agr. Chem. News and Pesticide Review*, July 22, 1957, pp. 34–38.)

Elements of Entomology - The Insect

By R. I. SAILER

Entomology Research Division, Agricultural Research Service

United States Department of Agriculture, Beltsville, Maryland

Among the elements of entomology which comprise the subject of our discussion I think we must concede that the insect is one of the most important. In fact, when I saw a preliminary announcement of this meeting and noticed that my contribution was entitled "The Role of the Insect in Entomology" it was my thought that I would need to do little more than stand up and say that without the insect we would have no entomology. On second thought, it seemed likely that this might not entirely please our program chairman; so I took a long look at the title and concluded that we could profitably ask ourselves just how insects have affected the growth and direction of entomology.

Certainly there is no question which came first. Insects

have the lead by 300,000,000 years plus or minus more years than man has been in existence. By this standard we can scarcely say that entomology is even a rank upstart. Not even if we admit an assertion of one of my friends that he was a member of the world's oldest profession. Before I had pulled my eyebrows down, he reminded me that Adam was a taxonomist and must have named some insects, for a passage in Genesis relates that God brought all the beasts of the fields and birds of the air to him and asked that he name them.

No doubt some economic entomologist will contend that Adam swatted the first mosquito that bit him even before he gave it a name, but I think we can safely contend that entomology started as a taxonomic science, which we can date from Linneaus' *Systema Natura* published in 1758. Economic entomology has been part of our community of sciences hardly more than a century, if we date its official birth from Harris' *"Report on Insects Injurious to Vegetation"* published in 1841. It was not until about 1870 that entomology began to receive recognition as a science and trail blazers such as Comstock, Fernald, and Packard started laying the foundation for modern entomology in America.

Now it is not my intention to dwell on the historical aspect of entomology. Rather I want to talk about the characteristics of insects that have shaped and continue to influence our science. By definition entomology is that branch of zoology concerned with insects. In practice it is more than this, for it includes the study of mites, ticks, spiders, and many other arthropods. Some entomologists even find themselves working on nematodes and snails. And here we have a key to one of the characteristics of entomology. To a considerable degree it is a science involving the application of special techniques imposed by the nature of insects. It is natural, then, that entomology will tend to include any study where similar methods are used. Obviously these techniques have been developed because of limitations and opportunities presented by the insects.

Insects are characterized by diversity of habits and structure, small size, abundance of individuals, and abundance of kinds. In practice each of these characteristics can be further subdivided, yet all are interrelated. Certainly we can hardly conceive of an aquatic insect without structural modifications that adapt it to live in or on the water. The same might be said of size in relation to number. Eight thousand arthropods can find elbow room in the soil covered by an elephant's footprint.

Diversity of habit and structure among the insects is reflected directly by the subject-matter fields of entomology. Apiculture exists because of the habits and structure of the honey bee. The bloodsucking habit of mosquitoes and other arthropods combined with their ability to transmit some of man's most deadly and debilitating diseases is ample explanation for the rise and growth of medical entomology. Plant pathologists are becoming increasingly aware of the importance of virus diseases, most of which are transmitted by insects. Entomology is responding by increased activity in classification of groups containing vectors and in research on control, through either reduction of the vector or the development of resistant plant strains. It might be argued that the latter is the concern of plant pathologists and plant breeders. Even so, these people must have entomological training, or the assistance of an entomologist if they are to identify vectors and learn something of their ecology.

The habits of parasitism and predation among insects, together with their ability to control undesirable plants, provide another active field affecting all aspects of entomology with ramifications extending far beyond our national boundaries.

The remarkable construction and modifications of the insects' exoskeleton enable them to occupy a vast assortment of ecological niches. Their wings are efficient flight organs without counterpart in the rest of the animal kingdom. Other animals have had to sacrifice walking appendages and ground mobility for power of flight, but not insects. As a consequence, many insects have excellent powers of dispersal, which complicate the control of such native pests as the potato leafhopper and too often frustrate our best efforts to contain the spread of introduced species. Control measures are further complicated by differences in structure of mouth parts and in the type of metamorphosis. Terms and technics such as stomach versus contact poisons and larvicide versus adulticide reflect these differences and are familiar to all of us.

Small size is another important characteristic of insects. The largest species are larger than the smallest vertebrates, and the smallest species are smaller than some protozoa. The vast majority are nearer the lower limit, for small size seems to afford many advantages. Basically, abundance of kinds and of individuals may be attributed to or correlated with this factor. There simply wouldn't be room or sufficient food if all insects were as large as the smallest vertebrates.

As small organisms, each making a small demand on available food resources and shelter, insects are able to maintain themselves in ecological niches where larger animals would starve. Equipped with the powers of dispersal already noted, populations are able to scatter in search of new food resources, and their amazingly high reproductive potential soon replaces losses suffered en route.

In the number and small size of insects we see something parallel to, if not a direct manifestation of, one of the basic laws of nature relating to matter and energy. The second law of thermodynamics postulates that any spontaneously occurring action will result in the transfer of energy from a concentrated to a more dispersed state. This seems to describe a phenomenon familiar to all entomologists, and perhaps best expressed as "every flea has a smaller flea to bite him." To describe the function of this principle in entomology, we need only to note that energy captured by plants from the sun enters our energy system as carbohydrates and proteins, which then become available to animals, and as one flea falls victim to another this energy is dispersed through the biocommunity. No group of organisms is better adapted for this process of gradual dispersal and slow degradation of energy. Our economic problems involving insects are rooted in man's need for this same energy. The prospect that there will be four human mouths to feed in the year 2050 for each mouth fed in 1950 has implications that are only too obvious.

Finally, I want to talk about the insect in terms of number of kinds. This to me is the most important problem confronting entomology. There are too many insects and too few entomologists. Already we have named 700,000 kinds and it is doubtful that the job is half done. To add to our problem, more than 80 percent of all insects undergo complete metamorphosis and for practical purposes each presents us with four kinds of organisms—egg, larva, pupa, and adult. These life forms of the same species have distinct structures and different ecological requirements, which must be recognized and treated by entomology in different ways.

Many biologists and some entomologists fail to appreciate the full extent of the problem of number. No such problem exists in vertebrate zoology. I am told that for 8,600 birds there are at least 150 research and museum men who are actively interested in bird systematics but who publish little in taxonomy for the simple reason that bird classification is nearly complete and they can put their efforts to more profitable use in other fields of bird biology. In addition, there are a host of people who can identify most of the birds of their region on sight.

The situation in insects could scarcely be more different. Here, at most, 300 people work on 220,000 beetles, and for the tenebrionid family of 17,000 species there are but 3 specialists. A beetle family containing as many species as there are of birds may be without a living authority. For the hemipterous family Miridae of perhaps 8,000 species there is only one world authority and possibly 6 or 8 people who are competent to handle regional faunas.

This problem is not one of concern to taxonomists alone, but touches every field of entomology and has ramifications

in biology generally. The principal reason for naming a species is to enable us to talk about its habits and relate it to other organisms including ourselves. Even a casual knowledge of a species involves facts relating to anatomy, life cycle, distribution, host plants, physiology, inter- and intra-specific relationships, and in the case of economic species we must add information on control.

Data on all these subjects are accumulating each year at a rapid rate. To appreciate this you need only to look at a volume of *Zoological Record*, the *Review of Applied Entomology*, or the INDEX TO THE LITERATURE OF AMERICAN ECONOMIC ENTOMOLOGY. Each year the task of recovering and utilizing the available knowledge becomes more difficult, and inevitably work is duplicated with little prospect that the duplications will be discovered and perhaps serve as useful replication.

In lustrial corporations, whose business operations involve only a small fraction of the detail and plain record keeping that confronts entomologists, resort to machine processing and recovery of data. Entomologists should be giving serious thought to the development of a coding system that will permit the extraction of multiple combinations of data regarding insects and their relations to their environment. If an information center were in existence and fully equipped to process and retrieve such information, professional entomologists would be relieved of the laborious task of answering inquiries concerning many technical matters. Their activities would be expedited by fast, thorough bibliographic searches, and much more of their time could be spent in productive and professionally satisfying work.

By way of summary–I think we can conclude that the insect has called the tune to which entomology has danced. We only need to look at the sweeping changes in chemical control and the revived interest in biological and cultural approaches to insect problems since the advent of resistance to DDT in order to appreciate the dominant role of the insect. Even so, this experience is heartening; for, not only have we gained deeper insight into basic biological phenomena governing population dynamics but in DDT and a versatile family of insecticides, we still have effective weapons for the control of many pests. If we seem to have lost the initiative, at least we held the baton for a while and as we gain experience perhaps entomology can influence insects in a degree approaching the influence insects have on entomology.

Elements of Entomology - The Program

By ROBERT GLEN

Associate Director, Science Service

Canada Department of Agriculture, Ottawa, Ontario

As suggested by the *Program Committee*, I will confine my remarks primarily to a program of entomological research in a government department, with special consideration of the question of balance among different types of research. For convenience in discussion, I use the term *research* in the broad sense to include all kinds of experimentation and investigation.

With minor exceptions, planning and research are inseparable. But the planning *of* research and the planning *for* research are two different functions. The former is mainly the responsibility of research officers, the latter of administrators. The development of a research program, however, involves both types of personnel intimately.

Planning the program usually entails successive decisions on such matters as primary objectives; allocation of major functions; projects and their subdivision into discrete lines of work; scheduling of staff and equipment, supplies and materials, and the necessary funds; and arrangements for suitable direction, supervision, and administrative control. In entomology, we must also consider the insects. Hence, the topic assigned to me in this symposium embraces, in its broader implications, all that has already been said by the two previous speakers about the *man* and the *insect* plus what the next speaker will add on the *economics* involved. Obviously I must restrict my remarks to a few of the many elements that bear upon the *program*. I shall examine three broad aspects: types of research, some other administration considerations, and some promising fields for future investigation.

TYPES OF RESEARCH.—All research is purposeful; but the underlying objectives, the motivating philosophies, and the basic approaches vary with individuals and institutions. For example, the traditional entomological interests of a government department of agriculture and of a university department of biology are basically different. The government department is interested mainly in protecting individuals, industries, and trade from noxious insects. The university department is interested in entomology primarily as a field of knowledge to be plumbed and taught. Consequently, in the university research need have no other purpose than the intellectual stimulation of students and professors or the furtherance of knowledge; it may be undertaken as an end in itself. But in the government service, research is normally undertaken because it leads to the solution of practical problems; here it is primarily a means to an end. Research that is pursued as an end in itself, I prefer to call *pure* or *academic* research; that which is undertaken as a means to an end, *applied* or *economic* research. Hence it is not so much what is done as *why* it is done that distinguishes these primary categories; and in pure research it is usually the man that is supported, whereas in applied research it is the project. Clearly, these distinctions have significance at the administration level only. No difference whatever should exist at the operations level, where the research worker must proceed in precisely the same manner and, I trust, with the same freedom for his creative imagination whether he be working on a pure or on an applied project.

This concept of applied research is somewhat broader than that commonly proposed. For example, it embraces much more than the simple application of existing knowledge to specific situations. Instead, I regard the pure and applied fields as each covering the whole range of effort from the strictly observational through the short-term trials to the most theoretical, precise, and long-range projects; in other words, each primary category includes the three types commonly referred to as background, development, and fundamental or basic research. For example, to me, basic research is either pure or applied research that has as its objective the understanding of the causes of some observed phenomenon or event. Such work is just as relevant to the interests of government departments that are charged with finding solutions to insect pest problems as it is to the interests of university departments that seek to discover the same kind of information for quite a different reason. At this point we are no longer involved in a question of why research is done but rather in *what* research is done. This is usually decided by the quality and quantity of available research resources, demands that compete for these resources, and the general research policies of the institution concerned. By classifying work in pure research and applied research in precisely the same

terms (background, development, and basic) we also acknowledge that not all pure research is basic or fundamental and not all applied research is empirical.

We must recognize, of course, that all such classifications are arbitrary. In practice, distinctions are as likely to be of degree as of kind and mingling of types is common. There are no water-tight compartments. Furthermore, one type of research cannot be rated better or more important than another except in relation to a specific purpose; and good work or poor work is never determined by the category of the work. Hence, all development research, for example, is by no means mediocre or all fundamental research superior. Undoubtedly, each type has a place in a comprehensive government entomological program.

Pure research projects are rare in government programs for reasons already mentioned. I trust, however, that they will not be completely excluded. In my opinion, there should be an opportunity in every research organization worthy of the name for at least the most gifted investigators to undertake some research for its own sake. However, in an applied research organization, such freedom is not a right but a privilege or a reward and must be under administrative control. This freedom should grow out of distinguished service, it should be granted whenever feasible, and it should never be totally suppressed.

Background research is the systematic observation, collection, and organization of facts into useful reference material. It has provided, for example, information on geographic distribution of species, nature and extent of damage from pests, amount and persistence of insecticidal residues, gross identifying characters for species, seasonal- and life-histories, plant and animal hosts, and habits of mating, oviposition, flight, etc. Since living organisms have inherent capacity for change, provision of reliable background information is an important continuing requirement in any broad entomological program. Such factual information is not only of value in itself but also a prerequisite to the conduct of both development and fundamental investigations.

Development research is the adaptation of available biological and related information to specific purposes. Through this approach many important contributions have been made such as keys for identifying species; techniques for rearing insects in the laboratory and for measuring their abundance in the field; improved methods for applying, evaluating, and analyzing insecticides; and development of practical control programs. This type of research frequently achieves the primary objective of *practical protection* and in this sense can properly be regarded as the heart of the applied program. Undoubtedly it will continue to dominate government programs in the future as it has in the past. However, the quality of development research should continue to improve as our background and basic knowledge increases and our experimental techniques are refined. Indeed, every effort must be made to see that it does improve.

Basic research is concerned with the understanding of natural phenomena. It has increased slowly but steadily in government programs in North America over the past fifty years, the change in Canada being most marked during the last decade. Good examples from current Canadian work are: (1) the comprehensive, long-term, ecological studies in forest entomology, in which a concerted effort is being made to measure the abundance of certain pest species throughout the year and to explain the changes that occur from generation to generation in given localities; and (2) the investigation of the insecticidal action of organo-phosphorus compounds with a view to understanding the processes of toxicity in susceptible insects and the processes of protection in those that are resistant. This type of enquiry forms an essential foundation for the applied program and is bound to increase both relatively and absolutely as government research organizations mature. No problem is really solved until it is understood. Applied entomologists have a responsibility to themselves, to their employers, and to the public they serve to get to the bottom of at least the major entomological problems of the world so that the means of coping with them can be approached scientifically and intelligently. Fundamental research, I repeat, is not something apart, but a primary component of a healthy applied program.

May I say at once that I know of no ready formula by which to determine the best balance among the different types of research in an applied program. The optimum distribution of effort changes with time and is affected by many variables such as the major current problems, size and distribution of professional staff, quality of leadership at all levels in the organization, and facilities for research. At present on this continent, I doubt if more than 10 to 15 per cent of the entomological effort in government organizations is directed along truly fundamental lines. In my opinion, the applied program as a whole would be immeasurably strengthened if this percentage were raised, preferably doubled. As a target to shoot at in the next decade may I suggest the following: 5 per cent on basic pure research, 25 per cent on basic applied research, 25 per cent on background applied research, and 45 per cent on development applied research. This distribution of effort provides almost equal attention to the two major aspects of applied work: procuring pertinent facts and adapting these to practical purposes.

I must caution, however, against developing a fetish for balancing the program along such lines. Distribution of effort is important, but it is not the final goal. The real objective in a government department is the attainment of a high level of practical protection from pest species and any shift in emphasis should be made with this ultimate objective clearly in mind. Balance among types of research should contribute to this end, but the surest way to improve the value of the program as a whole is to raise the quality of performance within each type of research and, better still, within each project. Most progress in human endeavor is achieved through the raising of one's own standards. This must continue to be the major incentive of all individuals connected with the research program if full effectiveness is to be attained.

OTHER ADMINISTRATION CONSIDERATIONS.—As implied earlier, the nature and quality of the applied research program are affected profoundly by administration policies that bear on use of personnel and other research resources. A few relevant concepts are discussed briefly in this section.

Research administration is required in differing degree at all levels from the project leader to the director-general of the whole research organization. But the basic requirement is the same: ability to give character and direction to the respective programs while preserving maximum freedom of thought and action for the individuals involved. Primary objectives at all levels should be clarified without delay and made known to all concerned. The procedure in project development should be defined. Here again tact and judgment are called for in the skillful combining of freedom for the researcher with the veto power of administrative authority. Central control is needed to give unity to the whole organization and to place responsibilities clearly. When used discreetly it protects the researches and the research workers more than it restricts them. A prudent administrator invariably gives precedence to what is good for research over what is convenient for administration. Furthermore, central control implies neither complete centralization nor autocratic domination. On the contrary, as organizations increase in size much authority and responsibility have to be decentralized, with compensating emphasis on intercommunication and coordination. An effective means of achieving intercommunication, better morale, and sounder major policies is the democratic approach of *group management*. In this method, the initiative and leadership and final decisions rest with the senior authority, as they must, but key personnel from all appropriate ranks contribute ideas and participate fully in the definitive discussions. Creative people usually work more effectively within a framework that they have helped to shape.

The administration should strive to provide career opportunities for research staff at each of its establishments.

This requires a decision to pursue *in depth* at least one field of investigation at each permanent laboratory. This decision must be in harmony, of course, with the broader policy on grouping of types of staff and types of research. In general, I feel that the long-range aim should be to bring together in one laboratory staff trained in all cognate scientific disciplines that bear directly on the field of study, with a minimum of two individuals in each discipline to reduce the disadvantages of extreme professional isolation. I also favor, as a general policy, grouping all types of research under one roof as opposed to separate laboratories or administrations for fundamental work. The advantages are: (1) the specialist staff serve as scientific consultants to their less-specialized colleagues and contribute materially to the sort of research atmosphere that promotes higher standards of performance; (2) the crucial aspects of practical problems are exposed more frequently and from more viewpoints to the scrutiny of critical minds and this increases the chances of the all-important breakthroughs in research; and (3) the basic research staff are more likely to concentrate their attentions on lines of work that bear directly on the development requirements of the program. In my opinion, one of the greatest needs in applied entomology in North America today is the proper fitting of young specialists into existing laboratories and organizations.

However, the ultimate grouping of types of research and types of staff in a government department is likely to depend on more than entomological considerations. Insects are but one of many interacting factors affecting the quality and quantity of agricultural and forest production. Conversely, the economic significance of many, perhaps of most, insect pests and the suitability of measures for their control are determined to an important degree by non-entomological aspects such as crop variety, soil fertility, plant disease, and established husbandry practices. For these reasons, the program of applied entomology should be prepared and carried out as an integral part of the whole land-use program of the region or the nation. Such a development might eventually force entomological and associated research administrations to plan most of their research along common lines, perhaps on the basis of individual crops or groups of closely related crops, and to develop effective arrangements for coordinating related aspects of federal, state (provincial), university, and industrial programs.

Government research directors are often harassed by pressures to start new *ad hoc* work on behalf of special-interest groups. There is no easy remedy for this knotty and inescapable problem. The best defence I know is simply to refuse to undertake any new work unless (1) it can be performed in accordance with *your* standards for good research, (2) you have reasonable assurance that it can be carried through to completion and with good chance of success, and (3) you can do it without prejudice to useful work already in course. An administration that cannot, with few exceptions, provide this degree of protection for its research program is likely to have an uncertain and an unhappy existence.

FUTURE LINES OF RESEARCH.—In applied entomology, we must go on indefinitely towards better identification of pest species, more accurate prediction of outbreaks, and improvement of control measures. Practical control must ultimately rest on a comprehensive knowledge of the ecology of farm crops, livestock, and forests and on a proper understanding of the effects of pesticides as one of the many interacting variables. These are certain to be broad permanent features of future research programs. The changes that will occur from year to year, or even from generation to generation, will be mainly in detail and emphasis. However, certain fields of research that are relatively inconspicuous at present will likely flare into prominence as new knowledge accumulates and new techniques become available. Programs will change accordingly. In the short time remaining to me, I wish to refer, with a minimum of discussion, to a few fields that I feel should be kept under special observation with a view to increasing attention when circumstances warrant. I shall not attempt to cover this subject comprehensively.

Taxonomy and comparative biology at the subspecific level should be greatly intensified in the interests of both systematic and economic entomology. Geographical and physiological races have forced themselves on our attention repeatedly. It is high time that we addressed ourselves seriously to a systematic comparative study of the biology of populations of the same species from different localities, for it is the local populations that the economic entomologist normally deals with rather than the species as a whole. Until we know much more than we do about intraspecific variability in physiological and ecological as well as morphological characters, our concept of the basic taxonomic unit, *the population*, must remain hazy and unsatisfactory.

The physiological basis of attractancy in insects, being a difficult problem, requires a concerted attack upon it. Such knowledge bears upon the important phenomenon of host selection and upon methods of control, such as trapping, use of repellents, and development of resistant varieties. Traps baited with odorous chemicals have already served well in special control campaigns, but little more than a beginning has been made to exploit this method scientifically. Not only chemical stimuli but also ultrasonics and other physical phenomena remain to be investigated in depth in relation to insect behavior. The possibility of luring noxious insects to convenient abattoirs instead of pursuing them into every nook and cranny is, I hope, too intriguing to be neglected much longer.

The physical aspects of insecticide use is another important but relatively neglected field. I refer to the factors that govern such phenomena as wetting, spreading, penetration, deposition, and persistence of insecticides in relation to their initial and residual toxicities. These phenomena differ with formulation: solutions, suspensions, emulsions, and dusts; with method of application; with kinds of surface and substrate; and with prevailing meteorological conditions. These aspects should be systematically and intensively covered in parallel and companion studies to the penetrating work that, fortunately, is now rather widely in course on other factors in toxicity, such as the biochemistry and physiology of the cuticle and enzyme systems.

Other lines of investigation of comparable future interest include:—

1. Improved methods for controlling the environment in which we grow plants and insects for research purposes and under which we perform critical experiments. Interest in Canada has risen recently on the comparative merits of greenhouses and other types of plant-growth rooms and cabinets for these purposes.

2. A better knowledge of individual differences in insects as illustrated by Wellington's[1] fascinating study of the western tent caterpillar, *Malacosoma pluviale* (Dyar), and the significance of such differences in the interpretation of life-tables and other ecological data bearing on population behavior and on the forecasting of changes in insect abundance.

3. Critical evaluation of the losses caused by insects to provide a better scientific basis for estimating insect damage, forecasting insect hazard in terms of known or expected pest abundance, and determining the population levels at which the application of insecticides is economically and ecologically sound.

4. Collaboration with mathematicians for two purposes: (a) to accumulate adequate amounts of the right kind of biological information for the construction of better mathematical formulae for use in entomology, that is, formulae derived from entomological, or at least biological, rather than from physical phenomena; and (b) to develop a system of taking and of recording research data so that their maximum value can be realized

[1] Wellington, W. G. Individual differences as a factor in population dynamics: the development of a problem. *Can. J. Zool.* 35: 293-323 1957.

through greater use of mechanical computers and other aids to comprehensive analyses.

In conclusion, may I urge administrators to publish the concepts and convictions derived from their experiences. This responsibility has been commonly neglected in the past with the result that the art of research administration, including systematic program development, is still in its infancy whereas business administration is at least well along in adolescence. Research administration must be taken seriously if it is to improve and mature. The best way of ensuring this is to set down our views for others to consider. It is with this objective in mind that I leave the above thoughts with you for what they are worth.

Elements of Entomology - The Economics

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In the context of this symposium, several approaches to this subject are possible. One is a general summation of the classic concept of economic entomology involving a generalized exposition of economic losses caused by insects with the usual classification of control practices into chemical, biological, cultural, legislative, etc. Another approach involves the problems and costs of developing and marketing a new insecticide from the viewpoint of the chemical industry. A third would be a plea for more emphasis on basic research as the supporting foundation on which any applied science must rest.

The approach taken in this paper, however, is limited to agriculture and is directed toward a basic evaluation of economic entomology in relation to agricultural economics and the responsibilities that the entomologist must accept under conditions of modern industrialized agriculture.

ROLE OF AGRICULTURE IN OUR ECONOMY.—Although we are primarily interested in developing the relationship between the economics of entomology and the economics of agriculture, let us first establish the position of agriculture in our total economy.

First of all, ours is an industrial economy—not an agricultural economy. Receipts from farm marketings (not total farm income) are running at the rate of about $30 billion annually compared to a gross national product of over $400 billion per year. Furthermore, approximately half of the total income of all persons living on farms is derived from non-farm sources.

To debunk farming as a "way of life" is almost sacrilegious and those of us with family roots deep in farming traditions may find it difficult to accept the fact that agriculture is only one of several major segments in our modern industrial economy, and not the single dominant factor that it was only a few decades ago.

COMPETITION IN AGRICULTURE.—The market for agricultural products as well as manufactured products is dependent upon mass consumer purchasing power, and anyone in contact with farmers today is keenly aware of their consumer-directedness. The emphasis is on such factors as quality, color, fruit finish, packaging, rapid transportation, storage, maturity control, etc. This is characteristic of highly competitive conditions—a buyer's market—an economy of plenty.

Under highly competitive conditions, the successful producers survive and the unsuccessful ones fail, ergo a marked trend toward larger and larger farming units as successful farmers take over their less successful neighbors' operations. For a number of years, the number of farms has been decreasing and the average size of farms increasing even though there has been no decline in the acreage under cultivation. In the one year from 1955–1956, there was a 2 per cent decrease in the number of farms—this is one farm out of every 50 going out of business in a single year.

This is admittedly an over-simplification since such factors as the draining-off of the farm labor pool into industry, support prices on basic crops, wartime pressures on increased production, inflationary trends, and others have been factors that have contributed materially to the slowing down or speeding up of this trend.

Technological improvements in agriculture have not only allowed agricultural production to keep pace with a rapidly expanding population brought on by our industrialization, but to keep ahead of it. In fact, rapid adoption of new technological developments is characteristic of the successful farmer under the highly competitive conditions prevailing today.

The farmer is not only competing with his next door neighbor, but he is competing for his share of the consumer dollar in several different directions. The consumer not only expects high quality foods, but also expects them to be attractively packaged and, in many cases, partially prepared in the form of frozen foods, canned foods, TV Dinners, and now fresh orange juice is delivered to the door in the New York area by the milkman. Dietary fads and synthetic vitamins have been important competitive factors. The decline in per capita consumption of potatoes and the increase in per capita consumption of meat and rice have had profound effects on the agricultural economy of some areas. The rapid and large scale consumer acceptance of processed citrus juices has had important effects on the market for other fresh and processed fruits.

It should be noted also that consumer buying habits can be influenced in the direction of one farm commodity or another by well conceived and well directed advertising programs. This has been well demonstrated time and again by a number of farm marketing organizations.

Quality standards continually improve as new and improved varieties are introduced, and also continue to improve with respect to rigid control of insect contamination and chemical residues in marketed produce. We can expect nothing but continued pressure on the development of more and more rigorous quality requirements for agricultural products as long as we have the competitive pressures resulting from surplus production.

TRENDS IN AGRICULTURE.—The outstanding trend in agriculture is the enormous amount of specialization—both geographically and on individual farms. The subsistence farm is almost a thing of the past. The specialized apple grower, for example, buys his milk and many vegetables and farm products at the super-market in town. The modern farmer expects the same in the way of automobiles, television, entertainment, food, and general living standards as his middle income friends in town. He is concerned with market price fluctuations, taxes, buying and selling, and, in general, his outlook and manner of thinking is that of a businessman or manufacturer. His basic motive is the profit incentive and is primarily concerned with producing at the lowest *unit* cost and selling at the highest possible price. As a result, the basic concept of farming as a business is that of a production-line operation.

The decreasing percentage of our total population on farms and the trend toward larger farming units has already been noted. The structure and productivity of our farm population is even more striking. Out of 4,800,000 farms, the census bureau now distinguishes between the

3,300,000 commercial farms and the 1,500,000 "other" farms composed primarily of residential and part-time farms. These non-commercial farms represent about 32 per cent of the total number of farms but account for only 3 per cent of total farm production. Commercial farms reporting sales of $250—$5,000 amount to 43 per cent of the total number of farms, but account for only about 22 per cent of farm products sold. There are only a little over 1,200,000 farms or 25 per cent of the total, that report sales of $5,000 or more, and these account for 75 per cent of the total value of all farm products sold. In fact, only about 10 per cent of the total number of farms report sales on $10,000 or more and these account for about 50 per cent of the total value of all farm products sold. We can be sure that this group of farmers includes the first to adopt and use new and improved varieties, new technological improvements, and new and improved marketing practices and quality standards. These are basically practices which lower unit cost when viewed from a production standpoint and serve to maintain these producers in a favorable competitive position.

Geographic specialization in agriculture is a striking reality and the trend is continuing. It is not surprising that most of our citrus and other sub-tropical fruits are grown in only a few counties. Perhaps of a little more interest is the fact that almost a third of all grape vines are in one county and almost a third of all pear trees are in three counties. Three counties in one state in 1954 had 10 per cent of all apple trees and produced 20 per cent of all apples harvested. Perhaps more striking is the fact that during the period 1949–1954, the total number of apple trees declined from 50 million to 31 million and the apples harvested declined from 131 million bushels to 109 million bushels, while during this same period the number of apple trees of all ages increased from 2,700,000 to over 3,000,000 in the three counties referred to. Cotton production in the irrigated valleys of California, Arizona and New Mexico has increased since the last war from a negligible amount to about 22 per cent of the total cotton production. It has been estimated that if government controls were eliminated, these states plus the irrigated areas of west Texas would soon be producing 75 per cent of our total cotton crop.

Trends in individual farm specialization have been almost equally as striking. In the period 1950 to 1954, the number of farms selling chickens declined by about 40 per cent, but the average number of chickens sold per farm just about tripled. In the same period, the number of farms selling hogs and pigs alive declined by about a third, but the average number sold per farm increased by about a third.

Again at the risk of over-generalizing, these trends can be reasonably well summed up as the application of mass-production techniques to agricultural production problems as the principal means of lowering unit production costs under highly competitive conditions. The concomitant results from the application of these techniques such as larger farming units, a high degree of specialization, greater productivity, rapid technological acceptance, etc. are the logical outgrowths or side-effects and not the causes in themselves.

These continued increases in farm productivity have led to serious difficulties in governmental control of our surplus agricultural production problem. Within the past few weeks, our population passed the 172,000,000 mark and by 1975 it is now estimated that our population will be about 222,000,000. Some estimates indicate that by that time we will be hard pressed to produce the food and fiber needed by our population. Others have estimated that if all of our present research knowledge could be applied, that agricultural production could be increased by as much as 85 per cent. I feel that most of this group would agree with the latter view.

Entomological Research Approach.—What does all of this mean in terms of our research programming in the field of agricultural entomology? If we take a critical look into the past, we find that our profession in the field of agricultural entomology has developed to a large extent as a "fire department" to put out the fires of insect infestations as they arise. Such a development was logical and necessary under the conditions prevailing, and the record of research and development in the field of control methods is one for our profession to be proud of.

Putting out fires will always be an important part of our agricultural activity, but we should also learn something about fire prevention. Basically, a broadening process is required in several directions.

First of all, we should establish our objectives in the field of agricultural entomology. The basic economic objective is the reduction of unit production cost to the farmer as measured in terms of increased yield, increased quality, etc. The application of basic research is largely dependent on the profit incentive, and consumer benefits generally derive from any such cost reduction in a free competitive economy.

The unit cost reduction approach carries with it the necessity that the production program be viewed as a whole, in terms of the entire cultural program of the crop involved. Entomologists in industry have had a good chance to come in contact with the interplay of various factors involved in crop production, at least from the standpoint of the use of chemicals. The use of fertilizers, minor elements, fungicides, herbicides, plant hormones, insecticides and other chemicals as well as the usual environmental factors of climate, cultivation, crop variety, water management, soil type, etc., all show interrelationships of one kind or another in the production of any given crop. Requirements of maturity control, storage, fruit finish, etc. are factors involved in evaluation as well as pest control and gross yield per acre. Many isolated examples can be cited where insect control practices, either chemical or biological, have been determined by the nutritional status of the crop, the prevalence of a plant disease, irrigation practices, cultivation practices, etc.

These factors obviously indicate the ecological approach. It is generally accepted that control practices amount basically to changing the environment of the insect by means of chemicals, or other means, and many excellent studies have been made on the ecology of a number of species of economically important insect pests. Is this the right approach, however, under today's conditions of industrialized agriculture? It would appear in the light of the economic objectives expressed above that the approach should be in terms of the ecology of the crop—the insect pests involved are only one or a few of the numerous environmental factors involved in crop production, all of which are interrelated.

There are obvious problems involved in experimental design due to the large number of variables involved. In recent years, some workers have taken the approach of population studies over extended periods of time and under varied conditions of crop culture, and these have come close to the heart of the problem. These studies have included the evaluation of combination biological and chemical control methods.

An approach involving the total ecology of the crop plant would indicate the application of the concept of the research team working in close liaison with each other and directed toward the solution of cultural problems as a whole rather than the solution of only one aspect of a problem. The research team approach to problems is almost standard operating procedure in industry, and the acceptance of this approach is due almost entirely to its success.

Although our professional pride may be hurt, we must admit that the entomological link in the chain of crop production is only one link in the chain and the ultimate success of the profession of entomology is dependent on the strength of all of the links in this chain of limiting factors in agricultural productivity. Each link in this chain can claim that if it were not for me, no crop can be grown. There are a number of examples of crops being driven out of a particular area or environmental complex due to insect problems, but I cannot find a single case where the consumer has been deprived of the product on a broad scale

or for any significant length of time since other sources of supply are normally available.

If the problem of economic entomology is to be approached in this manner, where do we find the man power and the funds to carry out these research programs. In the opinion of the author, greater attention must be paid to avoiding duplication and even replication of work. Greater coordination and cooperation must be obtained and programmed within homogeneous areas of crop culture.

There is also considerable wasted effort in carrying out tests by inadequate techniques or by means of poorly designed experiments. Much of the work in insect control today can be classed as testing rather than research. In the chemical field of insect control, the net result of elaborate field tests in some cases simply confirms previously existing knowledge and does not add basically to our total pool of knowledge. Although testing will always remain an important part of our entomological activities, let us not confuse the issue by calling these activities research.

Test methods could be greatly improved and the value of test results greatly enhanced if we had a greater store of basic research information from which to draw. Fortunately, the entomological profession survived the fetish of statistical analysis that seemed to make of statistics an end in itself rather than a useful tool. More recently the fad has been one of standardization of test methods, but there are signs that we are emerging from this without more serious damage than some slowing down of progress. Insistence on small plot techniques under conditions where the biology and habits of the insect dictate the necessity of large plot techniques has also been a contributing factor toward the slowing of progress.

Test methods often do not yield results that are valid in terms of the economics of crop production. Costs of control practices are often not significant when compared with the dollar value of the yield differences involved. In the case of cotton, it is seldom that differences in yield of less than 100 pounds of lint cotton per acre are statistically significant. In terms of market value to the farmer, this is close to $30 per acre. One application of insecticide can be made for about $1.50 per acre including application cost or a ratio of 20 to 1. Other less extreme examples could be cited, but, in any event, it would appear that a sound economic basis for insect control recommendations is lacking unless the accuracy and economic reliability of testing techniques and methods can be improved by research. Because of failure to properly evaluate the economic consequences of insect control recommendations, farmers in some areas have come to proceed on their own initiative rather than follow the recommendations of local entomologists.

Research Responsibility.—The opinion has been expressed by some entomologists working in close contact with farmers that they feel that their primary responsibility is to the small farmer since the large one is able to look after himself. On the other hand, the large successful and progressive growers are the ones who offer their farms and orchards for field plot studies, and are the ones who are usually the most active politically in influencing the appropriation of funds for the support of agricultural research and extension work. These latter farmers are also the first to adopt new technological improvements, whereas the former relatively unsuccessful group are generally extremely slow and conservative in adopting new methods and recommendations.

Certainly there is a responsibility to both groups, but neither can we escape the over-all responsibility to the community as a whole, the major segment of which is composed of the consumer—the taxpayer.

On gross inspection, it would appear that at least 75 per cent of the time and energies of economic entomologists are being directed to the problems of the 25 per cent of the farmers who produce 75 per cent of our food and fiber. This is due to the two reasons of cooperativeness and technological interest on the one hand, and influencing the direction in which research funds are used on the other hand.

Work in this direction also satisfies the responsibility to the consumer since improvements developed are rapidly applied and lead to better quality and more abundant food at relatively lower costs to the consumer.

The agricultural entomologist runs head on into the problem of the other 75 per cent of the farmers who raise only 25 per cent of our food and fiber when he tries to apply his research and test results "across-the-board". The entomologist prefers to carry on his field work on large farms with adequate equipment and facilities, with a cooperative host, and under well run and well managed farming conditions. He carries out his project successfully with sound data resulting from his research and testing program on which to base recommended procedures. He then finds that much of this data is not applicable to the small or marginal farmer who does not have the expensive equipment required, raises out of date varieties, has acreage or fields too small for mechanization, etc. It immediately becomes obvious that two entirely different problems are involved.

Let us examine the basic difference in operation and outlook of the small or marginal farmer versus the large grower. In the first place, any farmer selling less than $5000 worth of produce must almost necessarily maintain a one man or one family operation. Labor costs are high and modern standards of living are high. He can mechanize to the extent that one-man equipment will allow him to mechanize. He will swap the use of equipment with his neighbors and trade off his own labor with his neighbors of more or less equal size. Any activity or operation requiring an out of pocket cash expenditure will be viewed in terms of the fact that his own labor and that of his family does not require a cash outlay. Quality and production standards may be low due to the fact that he has a part-time or full-time job off the farm and is not dependent on farm income.

For the large grower labor is one of the most critical factors. Not only is farm labor costly but it is often hard to get at the right time, and substantial capital investments will be readily made on mechanization. Farm labor costs represent cash expenditures along with chemical and other supplies. Quality and production standards are high due to the economic pressures previously discussed.

With these factors in mind as presenting two almost completely opposing viewpoints on the part of the two groups of farmers, it should be possible to apply current entomological knowledge in the form of simplified insect control recommendations to the problems of the small farmer without sacrificing research time in the direction of continued technological improvements. This means, of course, that the *best* insect control program in terms of technology may not be a *practical* program for the small farmer.

In conclusion, it should be pointed out that there is also a definite responsibility attending on those entomologists who are in positions of leadership to thoroughly evaluate research, testing and extension programs in terms of modern, industrialized agricultural trends. Many of us here may be faced within our lifetime with the problem of producing enough food and fiber to feed and clothe our rapidly expanding population. The solution to such problems when they arise in the future will depend largely on basic research undertaken today. Entomology as a profession must be prepared to meet this challenge.

EASTERN BRANCH, E. S. A.

The Eastern Branch will hold its annual meeting on November 24–25, 1958, in the Lord Baltimore Hotel, Baltimore, Maryland. The *Executive* and *Program Committees* recently met to plan several special features. While the usual call for papers will be issued about September 1, why not arrange now to bring an excellent paper and make this an especially good Eastern Branch meeting?

Ashley B. Gurney, *Chairman*
Program Committee

Mass Control of Insects: The Effects on Fish and Wildlife[1]

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INTRODUCTION

The mass control of insects carried on during the past ten years has made possible the economical suppression and, in a few instances, the near eradication of pest insect populations over widespread areas. These large operations, usually featuring the use of the airplane for applying insecticides quickly and cheaply, have proven to be the means of effectuating control programs which never could have been carried on through use of the techniques and equipment of early-day economic entomology. With the development of the methods employed in modern mass control came the introduction of new toxicants, well-adapted for use against insects because of their potency, low cost and wide availability. The present-day entomologist is thus armed with the means to carry on a control task of almost any magnitude.

This gift to economic entomology brought with it, however, new problems and additional responsibilities. When the control worker gained the ability to quickly distribute insecticides over great areas, he lost the ability to regulate their dispersion as precisely as he had formerly done. When he was given the halogenated hydrocarbons and the organic phosphorus compounds to kill undesirable insects more easily, he inherited substances, many of which also were more toxic to himself, domestic animals and other desirable animal species. Thus, the economic entomologist was placed in the position of having to be more careful about the use of his new weapons and to accept a greater responsibility for their application. He generally has accepted this responsibility, particularly with regard to safeguarding the health and welfare of his fellow man and of his livestock and animal pets. However, in many instances, these safeguards provide insufficient or no protection for fish and wildlife and, as a result, damage of varying degrees has occurred in certain programs.

WILDLIFE VALUES

Wildlife and fish are present in the environments of almost all species of insects which are subjected to modern mass control. From coastal marsh to mountain top we find aquatic or terrestrial vertebrates and certain higher invertebrates as well as their animal foods which we consider to be desirable parts of the environment. In fact, the entomologist rarely if ever operates in an area which has no wildlife of some importance.

The value of these wild creatures is manifold. Some, such as fish and fur animals, serve as the basis of large commercial industries. Others provide recreation in the form of fishing and hunting for some 25 million sportsmen in this country (U. S. Fish and Wildlife Service 1956). Actually, one of every three households has one or more fishermen or hunters. The combined expenditure of these people for equipment, travel, food, lodging and licenses is $3 billion each year, making fishing and hunting the number one sport in the country. In addition, there are probably as many or more people who do not pursue game but who enjoy wildlife for its esthetic value and as a source of relaxation from the pressures and tensions of modern living. These groups are appreciative of the benefits of effective insect control. At the same time they recognize the public need for maintaining adequate fish and wildlife resources—a need which is increasing daily as our population continues to expand and habitat for wildlife continues to shrink.

MASS CONTROL PROGRAMS

Insecticidal programs influence wildlife and fish populations in various ways. Sometimes the effect is quick and direct, as when the toxicant enters the body of the animal and injures it. One important avenue is by ingestion of poisoned insects. At other times, reduced food supplies and, in turn, perhaps eventual starvation may result after the insect part of the diet has been destroyed by the insecticide. Still another influence lies in the delayed introduction of residual insecticides into streams or lakes through the flushing action of heavy rains. The various large-scale control programs may act in any or all of these ways to affect the welfare or survival of wildlife in treated areas. With the many new insecticides and methods in use today for mass control, and the variety of ecological conditions to which they are applied for combating hosts of native and exotic insect pests, additional safety rules must be established for the protection of game and fish. Many precautions have been standardized and are being used now in the programs against the spruce budworm and the gypsy moth. Some of the newer problems, such as that involving the imported fire ant, may call for different methods of application, and additional precautionary measures.

Spruce budworm and gypsy moth. The programs against the spruce budworm and the gypsy moth, as well as a number of lesser insect pests of forests, can be discussed together, since the methods employed are alike (generally 0.5–1 pound of DDT per acre in oil applied largely by plane) and the general effects on wildlife and fish are similar.

Since inception of the spruce budworm program, over 10 million acres of forest land in the United States have been treated as has much additional acreage in Canada. Up to 1956, 4.6 million acres had been sprayed for gypsy moth control. In that year, funds were made available to spray about one million acres in New York, New Jersey, Pennsylvania and Michigan and in 1957 about three million acres were sprayed as the first steps in a program designed to eradicate this insect.

The history of spraying for these moths in this country shows relatively little damage to vertebrates. Although dead fish have been reported after spraying, investigation has shown losses usually to be relatively small. We do know, however, that DDT can kill fish in nature, and there are on record at least two episodes in which this insecticide, when applied for control of spruce budworm, has been found or reported to have caused widespread, severe damage to important fish populations.

One of these occurred in 1954 in the Miramichi River drainage in New Brunswick, Canada, where a treatment of only 0.5 pound of DDT per acre resulted in up to 91 percent mortality of young Atlantic salmon (Kerswill and Elson 1955). Losses of fish in an untreated stream were but two percent. Very heavy reductions of stream insects also occurred. While recovery of certain kinds of insects was noted the following year, the increase was insufficient to prevent serious starvation of young fish (Kerswill 1957). The other serious case of fish mortality following spraying for spruce budworm control took place in the Yellowstone

[1] Invitational paper presented at the 29th Annual Meeting of the Eastern Branch of the Entomological Society of America, New York City, November 25–26, 1957.

River drainage in 1955 (Cope 1956). Large numbers of dead trout, whitefish, and suckers, including many young of the year, were noted 3 months after the spraying along more than a 100-mile stretch of the river. Great reductions in numbers of aquatic invertebrates again took place. This loss of food appears to have been the chief cause of the fish die-off. There was a large hatch of young trout and good fishing the following year and by the summer of 1957 recovery of bottom organisms was judged complete except in one stream.

These two occurrences spurred efforts to learn more about the effects of mass DDT spraying over forests. Treatment of portions of the Miramichi River in 1956 produced results similar to those previously observed. In Montana in 1956, almost a million more acres were treated. Studies made by State and Federal agencies in 13 trout streams (Cope and Park 1957) indicated that trout *were not* directly affected by the spray, that numbers of aquatic and terrestrial invertebrates *were* materially reduced by the spray, and that repopulation of aquatic insects began in some streams before the end of the season. Studies in 1957 of newly sprayed areas in the Yellowstone River and its tributaries produced similar findings.

The Montana investigations have not definitely defined the cause of fish mortality in the Yellowstone River in 1955, but they have shown that extensive damage to insect populations is to be expected when the usual methods are employed.

Much the same results have followed gypsy moth spraying operations although no mortality of fish of the magnitude previously cited has been reported. A number of cooperative studies made by the U. S. Fish and Wildlife Service and the U. S. Department of Agriculture, when DDT was first being tested for control of the gypsy moth in the late 1940's, showed that losses of aquatic insects commonly ranged from 70 to 90 percent (Hoffmann and Linduska 1949). However, the number of dead or distressed fish in individual areas was relatively small. Reports of the 1957 program showed that in only a few localities could dead fish be counted in the hundreds or higher. Some of these incidents occurred when applications were made over open ponds, lakes, streams or marshes lacking a protective cover of trees. Ordinarily leafy canopies filter the spray and permit only one-third to one-quarter or less to reach the ground surface. Considerable mortality of crabs occurred in localities on Long Island where spray planes turned around or passed over tidal marshes bordering wooded uplands. These and other crustaceans are readily poisoned by DDT.

Unfortunately, studies on repopulation of aquatic insects following gypsy moth spraying have not extended more than 16 months after treatment. They have shown that species such as blackflies, midges and certain mayflies readily reinhabited sprayed areas but that other mayflies, caddisflies and certain stoneflies were still reduced in numbers during the following year (Hoffmann and Drooz 1953). These latter insects are normally the principal food of larger trout.

Amphibians and reptiles in aquatic habitats may be killed by forest spraying programs involving DDT. Overall losses are usually small (Hoffmann and Surber 1949), but in individual ponds mortality of some species may be complete or nearly so (Fashingbauer 1957). Terrestrial forms are less readily affected unless dosages are in excess of 2 to 3 pounds per acre (Goodrum, *et al.* 1949).

Mortality of birds definitely attributable to a single 1-pound-per-acre application of DDT in forest situations has been slight, and total populations have been little affected (Kendeigh 1947). Ordinarily, dosages must exceed 2 to 3 pounds of DDT per acre to be acutely toxic to the bird population as a whole (Mitchell, *et al.* 1953). However, losses may be somewhat higher if sprayings are repeated during the same season, owing to operational problems or otherwise. This was reported on at least several areas during the 1957 gypsy moth campaign. DDT intoxication of birds in forest spraying seems to result largely from ingestion of contaminated food since experimental application of DDT at the rate of 5 pounds per acre had no observable direct effect on eggs or nestling birds (Mitchell 1946).

Little direct mortality of mammals from DDT has been noted until the 5-pound-per-acre level is approached (Nelson and Surber 1947).

Although mass spraying of DDT for control of the gypsy moth or spruce budworm may cause some loss of fish, the effect of the alternative course—no spraying at all—also should be considered. Forests containing large numbers of dead or seriously defoliated trees are less humid and much more susceptible to fire than are healthy woods and, hence, provide conditions less attractive to the original bird and mammal life. Furthermore, the lack of leafy cover raises the temperature of streams and also permits increased silting of these waters, which, in turn, reduces the numbers and kinds of desirable fish.

Mediterranean fruit fly. The discovery in 1956 of infestations of the Mediterranean fruit fly in southern Florida has resulted in one of the most dramatic mass applications of insecticides ever seen in this country. The objective is to eradicate this pest so that citrus fruit growers in the United States will not suffer the depredations that have occurred in other parts of the world.

The primary control method for this all-out operation has been the application by airplane and ground equipment of a malathion bait spray at the rate of 0.5 to 0.75 pound of actual malathion per acre. Since the spray is dispersed uniformly over extensive areas (more than 800,000 acres since inception of the program) and commonly is reapplied up to eight or more times in a season (aggregate treatment of 6.8 million acres thus far), its chances of reaching terrestrial and aquatic organisms are excellent.

Fortunately, the toxicity of malathion to warm-blooded animals is relatively low. No documented losses of wild birds or mammals have been recorded although unconfirmed reports of dead parakeets have been received. However, malathion can kill fish, and laboratory tests have shown its toxicity to be equivalent to or somewhat greater than that of DDT (Applegate, *et al.* 1957). Unpublished observations of spraying operations showed that in certain areas considerable numbers (in some cases the majority) of killifishes and certain other species were killed or afflicted (Harrington 1956). Mortality extended for several days and appeared to be greatest in still, shallow water. Instances of mortality to tropical fish also were reported. In addition to the foregoing results, previous small-scale ground applications of as little as 0.2 to 0.25 pound of malathion per acre in either a granular or emulsion formulation caused complete mortality of killifish (Keller, *et al.* 1952).

Grasshopper and Mormon cricket. Mass control of grasshoppers and Mormon crickets is a common practice and is increasing every year. Of the 22 million acres of rangeland threatened in 1956, over 1.7 million acres were treated for grasshopper control and 72,000 acres for control of Mormon crickets. In addition, more than 4½ million acres of cropland were treated to reduce grasshopper damage. Minor outbreaks of these pests can be controlled with ground equipment, but the use of the airplane for major problems and where speed and rough terrain must be considered is becoming more important year by year.

When applied as sprays, the toxicants and dosages for control of grasshoppers are: aldrin or heptachlor—0.125 to 0.25 lb./A; chlordane—0.5 to 1 lb./A; and toxaphene 1 to 1.5 lb./A. The same insecticides in dry bran or wheat baits also are used for large-scale control of Mormon crickets but at dosages about one-tenth as great for heavy to extremely heavy infestations. Dieldrin, although not recommended by the U. S. Department of Agriculture for grasshopper control, has received increasing use by certain States at about half the dosages at which aldrin is applied. Even though these rates of application generally are smaller than for forest insect control, the amounts that actually reach the ground or water may be proportionately much greater owing to the lack of screening cover.

Because Mormon cricket habitat consists largely of open, nonirrigated land, few fish are present, and no losses of these animals from control operations have been reported. Studies of baiting programs with chlordane have shown that a few birds may be affected (Eng 1952). When aldrin was applied in bait at the rate of 0.2 pound per acre, a dosage considerably above that ordinarily needed for cricket control, there was a 70 per cent decline in the population of mice (Yeager and Sandfort 1953). Apparently, the bait proved very attractive to these animals. Rabbits and deer, however, were unaffected.

Grasshoppers frequent a variety of rangelands, pastures and crops. Studies have shown that insecticides applied for control of these pests at recommended dosages, particularly at the higher levels, present certain hazards to wildlife.

Aldrin when sprayed over prairie marshes killed from one-sixth to one-third of the juvenile ducks present (Knedel 1951, 1952). Ingestion of contaminated food was the apparent cause of death. Small reductions in numbers of song birds also have occurred, possibly in response to a shortage of food (Eng 1952).

Heptachlor has had no reported effect on warm-blooded mammals but has killed large numbers of crayfish (Thorfinnson 1952).

Chlordane reduced the production of ducks and other birds by over one-half when applied to a marsh (Hanson 1952) and is capable of killing large numbers of some fish (Linduska and Surber 1948).

Toxaphene is a well-known fish poison and can cause mortality at a rate as low as 0.1 pound per acre (Tarzwell 1950). Small losses of ducks and coots followed an application of 1.5 pounds per acre (Knedel 1951).

Imported fire ant. In the cases of the insect pests discussed up to now, we have had the benefit of at least a few years' experience in their mass control. The imported fire ant, however, presents a relatively new problem. The projected eradication program scheduled to begin in the fall and winter of 1957–58 will be the first mass operation directed against this pest, which occurs on over 20 million acres in nine southern States. We must attempt to predict the consequences to fish and wildlife, therefore, rather than fall back on past experience.

The amounts of chemical recommended for area treatment of the imported fire ant are 2 pounds of dieldrin, heptachlor or aldrin per acre, or 4 pounds of chlordane per acre. Airplane, ground and hand treatments are planned.

Some of the hazards to fish and wildlife arising from applications of aldrin, heptachlor and chlordane were described previously. Accordingly, effects at the higher rates of application called for in the fire ant eradication program can be expected to cause correspondingly greater mortality of most vertebrates and invertebrates.

Observations already made on dieldrin in other control programs show that heavy losses of certain animals can be expected from a widespread area treatment of two pounds per acre. The toxicity of this material to fish is equivalent, or nearly so, to that of toxaphene (Mayhew 1955), and initial losses are encountered at dosages of 0.1 pound per acre and above (Hogan and Gray 1950, Webbe 1957). An application of one pound per acre killed most of the fish (estimated 1,175,000 dead fish weighing 20–30 tons) and almost all of the crabs in a 2000-acre marsh (Harrington and Bidlingmayer 1958). Significant repopulation of fish did not occur for 4 to 6 weeks, while in similar treatments elsewhere aquatic insects were greatly reduced in number and beetles continued to die for at least 10 months (Mathis and Quarterman 1953). A 1-pound-per-acre application also will kill some rabbits and ground squirrels (Ryckman, *et al.* 1953), and twice this dosage was sufficient to cause complete mortality of field mice in one test (Spencer and Spencer 1952). Some bird losses have occurred at 0.2 pound per acre (Ginsburg and Jobbins 1954) and a 0.5-pound-per-acre treatment killed large numbers of water birds and a smaller number of upland game birds (Rudd and Genelly 1956).

DISCUSSION

Mass control of insects by chemicals embraces all the hazards to fish and wildlife associated with less extensive methods of control and, in addition, presents certain new problems because of the extensive character of the treatments.

What are the fish and wildlife problems associated with mass applications of insecticides?

One of the problems previously discussed, particularly with applications by plane, is loss of control over distribution of the toxicant. Consequently, there often is contamination of habitats where the given pest does not even exist or where a more specific method of control would give results that would be just as effective. As has been pointed out, many forms of aquatic life are particularly sensitive to insecticidal poisoning. There is a very real danger that certain mass control programs could extirpate localized species of animals. Examples are some of the fish and reptiles of restricted range in the Southeast. The argument is sometimes given that even if wildlife is killed, repopulation can occur quickly from the outside. It is evident, however, that this is becoming increasingly less possible as more and more land continues to be treated.

Another problem is the matter of the delayed entry of highly toxic residual substances into aquatic environments. Although the pilot may carefully avoid direct contact with water or other critical areas, the chemicals may wash into lakes or streams with rains, and thus poison fish or fish food (Tarzwell and Henderson 1957). The occurrence of this type of poisoning has been demonstrated (Young and Nicholson 1951). Many of our important pests and control programs are centered in the southeastern United States, where rainfall is high. The flushing action of these rains may constitute a greater problem than initial direct exposure to the toxicant.

A third very important consideration which has been all but overlooked until recently is the question of sublethal effects of residual insecticides on fish and wildlife. This is not a problem that is peculiar to mass control procedures, but it is appropriate at this time to point out its importance. Most studies in the past have been concerned with determination of the numbers and percentages of fish, birds or mammals that have died following application of a toxicant. What of those animals suffering morbidity but not mortality? What of the effects of the toxicant on growth, reproduction, and other vital life processes? Not much has been learned in this area with fish, but it has been shown that adult pheasants that ate extremely small quantities of certain common chlorinated hydrocarbons, one two-hundred-thousandth of an ounce per day for a two month period, produced eggs of reduced hatchability and chicks subject to high death rates (DeWitt 1956). Feeding of one-fifth this amount to adult quail had a similar effect on their chicks.

Fortunately, many pests can be controlled by more than one insecticide or method of application. The control worker should select the toxicant, formulation, dosage, equipment, and operating procedure that will give reasonable control while inflicting a minimum of damage to fish and wildlife. In addition, there are other protective measures that should be employed.

(1) Insect infestations should be treated before they reach upper drainage areas or before they cover large acreages so that, if damage to wildlife does occur, repopulation can proceed more quickly.

(2) Careful ground-to-plane control should be provided to restrict application to intended areas, to insure even coverage and to prevent local overdosage.

(3) Direct application to streams, rivers, ponds and lakes, or to sites where rapid leaching into nearby aquatic areas might occur, should be avoided unless the rate of application is less than the toxicity equivalent of 0.2 pound of DDT in oil solution per acre. In forested areas dosages should not exceed one pound of DDT or its equivalent per acre.

(4) When an insecticide is used in an emulsion, the quantity should be reduced because of the greater toxicity of this formulation to aquatic animals.

(5) Applications around the edge of lakes should be made with small planes and when wind velocity is low. Where possible, ground equipment should be used in such situations.

(6) Pilots should avoid turns over streams, rivers and lakes and the use of these areas as boundaries for control operations.

(7) Applications of the more toxic materials should be avoided as far as possible during the brooding period of birds.

At times alternative methods may be more costly than those presently in use; nevertheless, it is believed that this increased expense should be part of the inherent operating expense of a balanced program and that, when all the facts are known, the public generally will support a more costly but safer operation.

It is most important that the wildlife biologist understand more about what happens to animal life when it is exposed to chemical insecticides. In connection with the problems mentioned above, he must ascertain the toxicity levels for different poisons in various formulations and in different environments. He must help the entomologist to determine the safest methods of applying chemicals. He must learn about the complex matter of the fate of highly toxic, highly residual substances so that lasting damage to fish and wildlife can be avoided. He must perform careful studies on the effects of continued or intermittent exposure to sub-lethal dosages, so that the total, long-term consequences will be understood. Only investigation of the interrelationships among wildlife species, their environment and food, and the toxicant will answer problems like those on the Yellowstone and the Miramichi.

The entomologist, however, should not wait for the fishery or wildlife biologist to conduct new studies. Already a great deal is known about the effects of some insecticides on animals, and guidelines have been set for safe practices in certain programs. The task at hand is to incorporate available knowledge into existing operations, and to develop new findings that will help provide effective control while safeguarding wildlife. The integration of these interests can be secured only by consideration of the total problem and by joint study by entomologists and wildlife biologists. This does not mean that there has been no appreciation or teamwork in the past, but, rather, that much more is needed in the future. It is fully recognized that all this takes time and money, but it will be a necessity if we are to develop well-balanced programs and to leave a healthy America for future generations.

SUMMARY

Mass applications of chemicals for control of insects present certain new dangers to desirable fish and wildlife resources, which are not inherent in less extensive treatments. They thus impose new responsibilities on economic entomologists. The direct and indirect effects on fish and wildlife resulting from programs for control or eradication of the spruce budworm, gypsy moth, Mediterranean fruit fly, grasshoppers and the Mormon cricket are reviewed. In addition, the hazards of the imported fire ant eradication program are predicted on the basis of what already is known about the effects of the insecticides and dosages recommended in this operation. General precautions for minimizing dangers to fish and wildlife are stated. In order to obtain well balanced control programs it will be necessary for entomologists and wildlife biologists to work closely together in developing and applying methods that effectively limit insect pests while providing adequate safeguards for fish and wildlife.

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ILLINOIS STATE NATURAL HISTORY SURVEY CENTENNIAL

The following resolution of the Illinois State Legislature will be of interest to many of our members. The congratulations of the Society are extended to Dr. H. B. Mills as well as to his staff, particularly the entomologists among whom are Past-Presidents G. C. Decker and H. H. Ross.

HOUSE JOINT RESOLUTION NO. 30

Whereas, on June 30, 1858, a group of far-sighted citizens of this State met at Bloomington and organized the Illinois State Natural History Society which was incorporated in 1861 by an act of the legislature; and

Whereas, In 1877 the name of the society was changed to the State Laboratory of Natural History, and in 1885 the laboratory was moved to Urbana where it was placed under the direction of the Board of Trustees of the University of Illinois; and

Whereas, The office of State Entomologist was established in 1867 and the State Laboratory of Natural History and the research activities of the State Entomologist's office were united in 1917 to form the State Natural History Survey Division of the Department of Registration and Education; and

Whereas, The Natural History Survey has rendered outstanding service in the field of natural history, especially in regard to the control of noxious insects, the control of diseases attacking floricultural and ornamental plants, the development of forestry in Illinois, the management of fishes in ponds and streams, the foods and movement of waterfowl in this State, the problems of upland game species, and the periodic report of species which are especially endangered, such as the prairie chicken and wood duck; and

Whereas, The following world recognized scientists and scholars have been associated with the wonderful work of the Natural History Survey: Stephen A. Forbes, Robert E. Richardson, David S. Jordan, Frank C. Baker, Charles A. Kofoid, Robert Ridgway, Benjamin D. Walsh, Wesley P. Flint, Victor E. Shelford, Theodore H. Frison and Leo R. Tehon; and

Whereas, since 1858 the Natural History Survey has received wide recognition for its contributions to society, has gained the respect of scientists throughout the world, has brought considerable prestige to this State, and above all, has contributed immeasurably to the welfare of all the people of this State; and

Whereas, The 100th anniversary of the Natural History Survey will be celebrated in 1958; therefore, be it

Resolved, By the House of Representatives of the Seventieth General Assembly of the State of Illinois, the Senate concurring herein, that this General Assembly, on behalf of all the people of this State, extent heartiest congratulations and sincere appreciation of the staff, members and employees of the State Natural History Survey Division, on the occasion of their 100th anniversary, for the outstanding contributions they have made toward the growth and development of this State; that we extend to them a wish for continued success and progress in the future; and that a suitable copy of this preamble and resolution be forwarded to the chief of the State Natural History Survey Division, Dr. Harlow B. Mills.

THESES

Dr. G. W. Simpson has advised of three theses recently completed at the University of Maine. These are available on interlibrary loan or on film from the library of Congress. Possibly other Universities would like to furnish similar lists of interest to entomologists, from time to time.

MORRIS, RAYMOND F. A study on the biology and morphology of the purple-backed cabbage worm, *Evergestis pallidata* Hufnagle, in Newfoundland.

MAIRS, DONALD F. A study on aquatic insects of a Maine farm pond.

FICKUS, THOMAS P. A contribution to the biology of the white spotted sawyer beetle, *Monochamus scutellatus* (Say).

RESULTS OF 1957 FUNGICIDE TESTS

The American Phytopathological Society for several years has sponsored the publication of results from tests on newer fungicides. The "Results of 1957 Fungicide Tests" for the first time has been printed privately and is issued as a single copy. This replaces the previous practice of combining reprints of serial articles published in "*Agricultural Chemicals.*" The "Results of 1957 Fungicide Tests" can be secured at $1.00 per copy only from Dr. A. B. Groves, Department of Plant Pathology and Physiology, Winchester Fruit Research Laboratory, Rural Route 3, Winchester, Virginia. All orders should be accompanied by remittances made out to The American Phytopathological Society. An added charge will be made for postage and handling where orders must be billed.

SOCIETY REPRESENTATIVES

The list of 1958 Society Representatives to other scientific bodies was printed on page 34 of the March 1958 issue of the BULLETIN. The Entomological Society of America has two Representatives on the Council of the American Association for the Advancement of Science. The name of G. H. Bradley was included in the list noted above. The second Representative has been announced by President Metcalf. He is Gordon Alexander of the University of Colorado. Representatives on the AAAS Council should therefore read as follows:

G. H. Bradley, Washington, D. C. ..... (1958)
Gordon Alexander, Boulder, Colorado ..... (1959)

PROCEEDINGS OF THE FORTY-FIRST ANNUAL MEETING OF THE PACIFIC BRANCH, ENTOMOLOGICAL SOCIETY OF AMERICA

Portland, Oregon, June 26, 27, 28, 1957

Chairman L. G. Gentner opened the Wednesday, June 26 session in the Empire Room of the Multnomah Hotel. Mr. Francis Ivansee, representing the Mayor of Portland, greeted the Branch members. Chairman Gentner responded.

H. M. Armitage, President of the Entomological Society of America, spoke on the subject: "As Seen in a Crystal Ball". He made numerous observations on the activities of the Society and included such suggestions as that of having freer choice of Branch membership by Society members, life membership in the Society, affiliation with other Societies, meeting times of Branches and of the Society, professional standards for Entomologists, scholarships, Branches in Canada and Mexico. He invited the Branch members to the Memphis meeting of the Society in December 1957.

During the preliminary business session the secretary read proposed Branch constitutional changes which would be presented at the annual business meeting on the afternoon of Friday, June 28. Chairman Gentner then made a few announcements.

After a short recess the paper reading sessions began. There was a total of 61 submitted papers, 10 minutes in length, presented during the 3-day sessions. They covered such subjects as: Insect control, new insecticides, chemistry of insecticides, taxonomy, forest entomology, biological control, virus vectors, potentiation and scholarship.

An invitational paper by R. W. Salt, Lethbridge, Alberta, concerned recent advances on the knowledge about cold-hardiness in insects. He discussed probable reasons for this and showed, among other things, that freezing resistance of insects and of salt solutions often bear a direct relationship to the amount of water present.

Roy Hansberry, Shell Development Company, spoke on the subject "Some Insecticide Problems Abroad". The value of insecticides exported from the United States had increased many times over in recent years. He discussed the problems inherent in surveying potential markets in foreign countries, in estimating probable sales, in monetary exchanges, in government regulations, and taxes.

Laurence S. Jones, U. S. Department of Agriculture, Entomology Research Branch, reviewed fruit tree viruses and vectors. He pointed out that the majority of fruit tree viruses have no known vectors.

A symposium on mites and mite control concluded with the observation that mite resistance to acaricides was a growing problem. A panel on Formulations considered the method best suited to meet the control problems of individual pest control projects. Another panel discussed how to attract prospective students to Entomology.

On Wednesday evening, June 26, a very successful Photo Salon was conducted by J. C. Chamberlin and C. W. Getzendaner. There were numerous entries of beautiful photographs of insects. The panel of judges awarded prizes in five different classes.

The annual banquet, on the evening of June 27, was well attended. It was followed by excellent entertainment and dancing.

The annual business meeting of the Branch started at 1:45 P.M, Friday, June 28, with L. G. Gentner presiding. He introduced R. H. Nelson, Executive Secretary of the Society, who was in attendance for the 3-day sessions at Portland.

The financial report of the Branch was as follows:

Old balance, June 24, 1956		$572.67
Income, 1956–57:		
Berkeley registrations	$714.00	
Refund from Secretary	30.00	
	744.00	
Expenses, 1956–57	627.24	
New balance, June 25, 1957		689.43
Disposition of money		
On deposit	681.70	
Cash on hand	7.73	
Total		$689.43

The chairman of the *Auditing Committee*, S. C. Jones, speaking for the Committee, which also included F. P. Dean and Keith Sims, reported the Branch accounts in good order.

The Branch *Membership Committee* report was as follows:

A total of 79 new members have been added to the Pacific Branch since July 1, 1956. Of these 38 reside in California, 16 in Arizona, 9 in Utah, 5 in Washington, 4 in Oregon, 3 in Hawaii, 2 in Canada, and one each in Idaho and Montana.

The total Branch membership is now approximately 1,104 which is 57 more than reported at the 1956 Branch meeting.

In addition there are 47 Society members presumably residing in the Branch whose addresses are unknown. This makes a potential total Branch membership of 1,151.

Respectfully submitted,

Geo. D. Butler, Jr.	Ed H. Littooy
Martin M. Barnes	Roland W. Portman
George F. Knowlton	W. P. Stephen
Dilworth D. Jensen	H. H. Pepper
Henry A. Bess	Robert E. Pfadt
Carl A. Johnsen	James K. Holloway, *Chairman*

The next order of business was the presenting of changes in the Branch constitution as recommended by the Branch Executive Committee. The first change, read by the Secretary, concerned re-definition of areas encompassed by the Branch. This was necessary due to assignments to the Branch by the Society Governing Board. The proposed reworded constitutional article was as follows:

ARTICLE II—MEMBERSHIP

Section 1. All members of the Entomological Society of America residing in Alaska, British Columbia, Washington, Idaho, Montana, Wyoming, Oregon, Nevada, Utah, California, Arizona, Baja California, Sonora, Sinaloa, in the Hawaiian and other Pacific Islands, are members of the Pacific Branch.

There was a question, principally raised by H. M. Armitage, concerning this revised Article based on the fact that the Governing Board had assigned Alberta and Saskatchewan to the Pacific Branch, but the Executive Committee had thought it best to leave these states out pending further information on the wishes of the Society members in those areas. This revised section received a majority of the votes of those present but not enough to conform to the 4/5 rule on constitutional amendments. C. O. Barnard then moved to table the section, which motion was seconded and carried.

The next constitutional revision was that of changing the term "Vice Chairman" to "Chairman-elect" in Article III, section 1, line 1, and in section 2, line 1. This change was approved by motion and vote.

A third constitutional revi ion concerned Article III—Officers. It is a rewording for the purpose of clarification and is as follows:

Section 3. A committee to nominate officers who are to be elected at the annual business meeting shall be appointed not less than 90 days before the date of the annual meeting. The two active members of the Executive Committee to be elected each year shall be members receiving the largest number of votes in an election held at the time of the annual business meeting; these nominations to be made from the floor.

This revision passed on motion with no dissent.

The fourth change in the Constitution was a proposed addition to the document as follows:

ARTICLE IX—RESOLUTIONS

Section 1. Resolutions, to receive action at the annual Branch business meeting must be presented in writing to the chairman of the Resolutions Committee on or before the first day of the annual Branch meetings.

This article was recommended by the Executive Committee to give the Branch Resolutions Committees adequate time to study resolutions so they could make proper recommendations upon presenting them in the annual business meeting, and thereby prevent inappropriate resolutions from being acted upon without adequate deliberation by the Resolutions Committee. Due to the statement in the proposed article that the resolutions must be presented "on or before the first day", objections immediately arose. C. O. Barnard moved the Article be tabled and the motion was seconded and passed.

H. M. Armitage called attention to the Society Memorial Lectures and asked that suggestions for this program be sent to Dr. W. P. Hayes, chairman of the Committee.

H. M. Armitage moved that the Branch approve and support the suggestion that a provision for Life Membership, be included in the proposed new Society Constitution. E. H. Littooy seconded it and the motion passed.

H. M. Armitage moved that the secretary of the Pacific Branch convey to the chairman of the Society Constitution Committee that the Branch favors a provision in the proposed constitution allowing any Society member to affiliate with the Branch of his choice, that such a request come through and be approved by the Society Governing Board. L. C. Glover seconded the motion, which passed.

The *Resolutions Committee,* composed of E. C. Klostermeyer, H. F. Madsen, and A. F. Kirkpatrick, drew up two resolutions which were read by A. F. Kirkpatrick.

Whereas, the members of the Pacific Branch of the Entomological Society of America, their families, and friends, have enjoyed an exceptionally well balanced and informative program at the 41st Annual Meeting.

Be It Resolved that the membership express its appreciation to the following individuals and groups who contributed to the success of the meeting:

(a) The Program Committee, H. S. Telford, Chairman
(b) The Arrangements Committee, K. Lee Sturges, Chairman
(c) The Committee on Arrangements for the Ladies, Mrs. K. Lee Sturges
(d) The Registration Committee, Carl R. Tanner, Chairman
(e) The Operations Committee, E. A. Dickason, Chairman
(f) Chairman Louis G. Gentner and all Committees, Officers and members who worked hard to make the meeting a success.
(g) President H. M. Armitage of the Entomological Society of America for his look into the crystal-ball, and to the invitational speakers.
(h) The Portland Chamber of Commerce for assistance with the registration.
(i) The management of the Multnomah Hotel for their help on arrangements.
(j) The members of Industry who assisted the Arrangements Committee in providing the entertainment features enjoyed by all.

Be It Further Resolved that the Secretary be instructed to write letters of appreciation to each of the above.

RESOLUTION NO. II

Whereas, an appreciative audience at the Insect Photo Salon was enthralled by the beauty of the insect photography.

Be It Further Resolved that the Pacific Branch of the Entomological Society of America express its appreciation to the Co-chairmen of the Salon, J. C. Chamberlin and C. W. Getzendaner.

Be It Further Resolved that the *Program Committee* give full consideration to the including a similar Insect Photo Salon on the program at the next annual meeting.

E. C. KLOSTERMEYER
HAROLD F. MADSEN
A. F. KIRKPATRICK, *Chairman*

The motion to accept these Resolutions was seconded and passed.

G. F. Carter of the Pest Control Operators Association moved that the Pacific Branch Chairman appoint a committee to study pest control laws in force in the various states encompassed by the Branch with specific reference to California, and make recommendations as to improving these laws. There followed some discussion during which a Portland pest control operator stated that the California laws governing pest control were so involved that even those attempting to enforce them were confused. Stewart Lockwood seconded the motion, which passed.

Chairman L. G. Gentner announced that the Executive Committee had chosen the El Cortez Hotel in San Diego for the 1958 Branch meeting, to take place on June 25, 26, 27. He further announced that future registration fees as set by the Branch Executive Committee would be $3.00 for Society members, and $5.00 for those not members of the Society.

The Branch *Nominating Committee* consisted of R. E. Campbell, E. P. Breakey and E. G. Linsley. Chairman Linsley reported that the Nominating Committee was placing L. M. Smith as its choice for Chairman-elect. L. A. Carruth moved that the nominations be closed and the motion was seconded and passed. Branch chairman Gentner then instructed the secretary to cast a unanimous ballot for L. M. Smith, Chairman-elect.

The next business was the nomination of two new active members for the Branch Executive Committee to replace L. A. Carruth and C. F. Doucette whose terms were expiring. J. C. Chamberlin nominated H. C. Manis of Moscow, Idaho and J. K. Holloway nominated H. S. Telford of Pullman, Washington. E. H. Littooy moved the nominations be closed, which motion was seconded and passed. Chairman Gentner then instructed the secretary to cast a unanimous ballot for these two nominees.

L. G. Gentner, retiring Branch Chairman, then thanked the Committees and other members who had made the Portland meeting a success. He turned the gavel over to the new chairman, L. S. Jones. Mr. Jones, after brief remarks, adjourned the business meeting preparatory to the last paper reading session.

There were 237 registrants at the Portland meetings of whom 188 were Society members.

Respectfully submitted,
H. H. KEIFER
Secretary-Treasurer

PROCEEDINGS OF THE THIRTEENTH ANNUAL MEETING OF THE NORTH CENTRAL BRANCH—ENTOMOLOGICAL SOCIETY OF AMERICA

St. Louis, Missouri—March 26, 27 and 28, 1958

Business Sessions

D. A. WILBUR, *Presiding*
C. W. WINGO, *Secretary*

Preliminary Business Session

The preliminary business session of the North Central Branch was called to order by Chairman D. A. Wilbur at

12:23 P.M., Wednesday, March 26, 1958 at the Sheraton-Jefferson Hotel, St. Louis, Missouri.

Chairman Wilbur announced the appointment of J. H. Lilly as chairman of the Resolutions Committee to replace C. D. Michener.

The Secretary was requested to report on the action of the Executive Committee to the membership.

Report of the Executive Committee

The first meeting of the *Executive Committee* was held at 9:12 P.M., March 25, 1958 at St. Louis, Missouri.

Branch Representative Bussart reported that the Governing Board of the Entomological Society of America had endorsed:

(1) An increase of $3.00 in annual dues of E.S.A. for editorial expenses and membership of the Society in the American Institute of Biological Sciences.

(2) The collection of $1.00 per member from all members of the parent Society. Said $1.00 to be returned to the member's Branch organization.

Discussion followed at length and it was moved and seconded that the *Executive Committee* go on record as favoring the $3.00 increase in dues and membership in A.I.B.S. The motion carried unanimously.

Discussion of item (2) i.e., the collection of $1.00 from each member by E.S.A. for return to the Branches revealed that the Cotton States and the Pacific Slope Branches actively favored this procedure and the Southwestern Branch and the Eastern Branch reputedly opposed it. The Executive Committee of the North Central Branch declined to take action concerning this item since all members of E.S.A. will be privileged to vote on both items at an early date. However, the *Executive Committee* urged each member of the North Central Branch to consult the March 1958 number of the E.S.A. Bulletin (pages 8 and 15) for full information on these items.

Second: The Secretary reported that according to instructions of the Committee given at Des Moines in 1957 all Canadian members of E.S.A. residing in Manitoba and in Ontario west of 80° longitude had been invited to petition the Branch for membership. A necessary two-thirds of the Canadians failed to petition for membership in the North Central Branch and all remain unaffiliated.

Third: The Executive Committee investigated the advisability of establishing a Standing *Committee on Publicity* as endorsed by the membership at the 12th Annual Meeting in Resolution #3. It was found that the parent Society is in process of establishing a committee on the national level. Therefore, the North Central Branch *Executive Committee* deferred action pending outcome of the E.S.A. board action.

Fourth: It was moved and seconded that speakers, not living in the North Central Branch area or non-entomological speakers, invited to speak on the general session program not be charged the registration fee and be given a banquet ticket. The motion carried unanimously.

Fifth: A motion to accord non-member speakers at sectional meetings the privilege of free registration and banquet ticket failed to pass.

Sixth: The Treasurer read the annual financial report.

The initial meeting adjourned at 12:11 A.M., Wednesday. The second meeting of the *Executive Committee* was set for 9:00 P.M., Thursday, March 27.

Chairman Wilbur then called for the report of the *Nominating Committee.*

Report of the Nominating Committee

The following roster of candidates was selected by the Nominating Committee for election to office at the 1958 annual meeting:

Chairman-elect—J. W. Apple
H. O. Deay

Executive Committee-Member-at-Large—R. K. Chapman

The committee reported this original slate of candidates had been changed by the withdrawal of J. H. Lilly and added the name of P. C. Stone as a candidate for *Executive Committee* Member-at-large by nomination signed by 12 active members of the Branch. As this nomination was in accordance with the constitution and reached the Secretary prior to the beginning of balloting, the name of P. C. Stone was added to the slate of candidates.

Chairman Wilbur adjourned the meeting at 12:35 P.M.

Final Business Session

The final business session was called to order by Chairman Wilbur at 9:00 A.M., Friday, March 28, 1958, at the Sheraton-Jefferson Hotel, St. Louis, Missouri.

The chairman called for new business. There was none and the chair called for the report of the second session of the Executive Committee.

Report of Second Session of Executive Committee

The second session of the *Executive Committee* was held at 9:00 P.M., March 27, 1958, at the Sheraton-Jefferson Hotel, St. Louis, Missouri.

The first item of business was consideration and selection of the site of the 1960 meeting. Milwaukee, Wisconsin was selected as the site of the 1960 meeting to be held Wednesday, Thursday, and Friday, March 23, 24 and 25, 1960.

Second: It was moved and seconded that Mr. Bussart be authorized to contact Canadian members regarding further action on their petition to join the North Central Branch. The motion passed.

The meeting of the *Executive Committee* adjourned at 9:59 P.M.

The chairman then called for the Treasurer's report.

Treasurer's Report

March 22, 1957 to March 22, 1958

Balance on hand March 22, 1957	$ 760.18	
Receipts during the year	1359.00	
Total		$2119.18
Disbursements during the year	1260.98	
Balance on hand March 22, 1958	858.20	
Total		$2119.18

A detailed copy of the Treasurer's Report was examined by the *Auditing Committee,* is in the files of the undersigned and will be published in the *Proceedings.*

CURTIS W. WINGO
Secretary-Treasurer

Report of Auditing Committee

The Treasurer's books have been examined and found to be correct.

Respectfully submitted,
HAROLD J. BALL
GEORGE W. THOMAS, *Chairman*

It was moved, seconded and passed that the reports of the *Treasurer* and *Auditing Committee* be approved.

Report of the Resolutions Committee

D. LYLE GOLEMAN
J. G. RODRIGUEZ
J. H. LILLY, *Chairman*

RESOLUTION NO. 1

Whereas, the business sessions of this meeting have been called to order by the use of a beautiful walnut gavel made for and presented to this Branch by Past-President Harold Gunderson,

Be It Resolved, that the members here assembled hereby case a unanimous vote of thnaks to Harold Gunderson for his thoughtfulness.

RESOLUTION NO. 2

Whereas, The Thirteenth Annual Meeting of the North Central Branch has had an interesting and

instructive program and has been pleasantly entertained, and graciously accommodated,

Be It Resolved, that the members of this Branch recognize and commend the splendid efforts of the *Committee on Local Arrangements*, the *Program Committee* and the officers of the Branch.

RESOLUTION No. 3

Whereas, the management and staff of the Sheraton-Jefferson Hotel have provided the facilities to make this meeting a pleasant and productive one,

Be It Resolved, that the members in attendance, through their Secretary express their appreciation to the hotel management for its assistance and cooperation.

RESOLUTION No. 4

Whereas, the Midwest Farm Paper Unit has again graciously cooperated with the Branch by printing its program gratis,

Be It Resolved, that the Secretary be instructed to convey our sincere appreciation to this group for its services.

RESOLUTION No. 5

Whereas, Professor Ray T. Everly and Mrs. Don Schuder are again devoting their time and talents to the task of assembling, editing and typing the *Proceedings* of our meeting for publication,

Be It Resolved, that this Branch express its appreciation to Professor Everly and Mrs. Schuder for their commendable services.

RESOLUTION No. 6

Whereas, the fifteen companies named on the back cover of the banquet program provided the funds for the ladies' tours and also for the floor show, corsages and table decorations at the banquet,

Be It Resolved, that the membership express its gratitude and appreciation for these courtesies to each of these concerns.

RESOLUTION No. 7

Whereas, reports of deaths of members or former members of the Branch often do not come promptly to the attention of our Secretary,

Be It Resolved, that associates or acquaintances of any such individuals report the death promptly to the Secretary, along with the name and address of the member of the family to whom a letter of condolence may be addressed.

RESOLUTION No. 8

Whereas, the number of visitors from outside the boundries of this Branch was unusually large and their participation even more active than usual this year,

Be It Resolved, that we express our appreciation for their interest and participation, and that we cordially invite them to come again.

RESOLUTION No. 9

Whereas, one of the principal objectives of an entomological society is to further the attainment of educational goals, and

Whereas, the science of entomology is too often minimized in our high school biology courses, and

Whereas, the quantity and caliber of our future entomologists often stem from interest at the high school level,

Be It Resolved, that members of this Branch do everything in their power to encourage and promote the teaching of special entomology courses for school teachers studying for advanced degrees during summer sessions and regular academic periods.

RESOLUTIONS 1 THROUGH 9 WERE ACCEPTED UNANIMOUSLY.

RESOLUTION No. 10

Whereas, the misuse and injudicious use of insecticides inevitably results in adverse criticism, and in some cases brings discredit on sound insect control practices, and

Whereas, such criticism or condemnation tends to discredit entomologists and the entomological profession,

Be It Resolved, that the North Central Branch entomologists here assembled condemn all unsound and unproven insect control practices, and

Be It Resolved, that we hereby solicit the cooperation of all agencies engaged in any insect control practices in an allout effort to eliminate the use of all unsound practices, and to secure the immediate correction of any defects that may be detected.

RESOLUTION No. 10 WAS ACCEPTED BY MAJORITY VOTE.

RESOLUTION No. 11

Whereas, members of the North Central Branch have often expressed a willingness to promote the professional welfare and status of the science of entomology and of entomologists, and

Whereas, affiliation with the A.I.B.S. would be one effective way of strengthening our Society and biological sciences generally,

Be It Resolved, that the North Central Branch go on record as strongly approving Entomological Society of America affiliation with the A.I.B.S., and

Be It Further Resolved, that members in attendance at this meeting recommend to all Branch members that they support plans for such affiliation.

RESOLUTION No. 11 WAS ACCEPTED BY UNANIMOUS VOTE.

RESOLUTION No. 12

Whereas, there is a definite need for professional editorial management and additional financial support for various publications of the Entomological Society of America, and

Whereas, if the Society is to continue to advance and meet the needs of the entomological profession,

Be It Resolved, that the members of the North Central Branch in attendance at this annual meeting recommend to the Branch membership that they vote in favor of increasing the Society dues $3.00 per year for the above-stated purposes.

RESOLUTION No. 12 WAS ACCEPTED BY MAJORITY VOTE.

RESOLUTION No. 13

Whereas, there is sentiment and some justification for the collection of one dollar ($1.00) per year by the National Treasurer from each member to be returned to the Treasurer of the Branch with which he is affiliated, and

Whereas, this proposal may soon be brought to a vote of the membership,

Be It Resolved, that the members of this Branch here assembled go on record as favoring this proposal, with the understanding that if it is approved the registration fees at our future annual meetings will be correspondingly reduced.

T. A. Brindley—I am against this resolution as our Branch has solved its financial difficulties alone and I see no use of

collecting this $1.00 increase in E.S.A. dues just to help other branches.

J. W. Apple—For several years I represented the North Central Branch on the E.S.A. Governing Board and I opposed raising dues during these years. Now, however, I believe it would be well to favor collection of $1.00 for return to the various branches in order to help other branches in their financial problems. In the North Central Branch we would be able to reduce the registration fee to $2.00 and the $1.00 from each member would insure that the total membership of the Branch helps support the Branch financially.

H. M. Harris—I, too, like Dr. Apple, represented the North Central Branch on the Governing Board, E.S.A. for some years, and I, too, opposed raising the dues for this purpose. While in the long run the objective has merit, I oppose raising the Society dues for this purpose at this time. It is my feeling that there are other matters of greater importance to the parent society than the subsidy of travel of Branch officers to national meetings that should have first priority.

THIS RESOLUTION (NO. 13) WAS NOT ACCEPTED BY VOTE OF THE MEMBERSHIP.

Report of the Membership Committee

From April 1, 1957 through March 20, 1958, 83 new memberships were granted in the Entomological Society of America from the North Central States Branch.

Each member of the Committee was assigned a group of states with which to work. An E.S.A. member was selected in each state to represent the membership committee. The Committee wishes to take this opportunity to thank those E.S.A. members for their help.

Our Executive Secretary, Mr. Nelson, was extremely cooperative in supplying names and addresses of E.S.A. members and membership blanks.

Respectfully submitted,
HARLAN SHUYLER
WAYNE COLBERG
H. B. PETTY, *Chairman*

Report of the Committee on Sustaining Associates

Two new Sustaining Associate members were enrolled by this committee for 1958. They are:

SWIFT & COMPANY
Agricultural Chemical Division
Chicago 9, Illinois

WISCONSIN ALUMNI RESEARCH FOUNDATION
Insecticide Testing Laboratory
506 N. Walnut Street
Madison 5, Wisconsin

We wish to acknowledge the help we received from our Executive Secretary, Mr. R. H. Nelson, and Mr. W. E. McCauley, Chairman of E.S.A.'s Special *Committee on Sustaining Associates.*

Respectfully submitted,
GALEN HINKLE
R. L. JANES
LEO G. K. IVERSON, *Chairman*

Report of the Nominating Committee

The Nominating Committee reported that the newly-elected officers of the Branch were:

Chairman-elect—J. W. Apple

Executive Committee-Member-at-Large—P. C. Stone

The chair called for Past-Chairman Mickel to escort the newly elected officers to the rostrum where they were congratulated and Chairman Wilbur yielded the gavel to the new Chairman, Roscoe E. Hill.

New Business

Chairman Hill announced that the 1959 meeting will be held at Columbus, Ohio, March 25, 26 and 27, 1959, with headquarters at the Niel House Hotel.

Chairman Hill appointed the following committees:

Program Committee—G. W. BYERS
E. E. KENAGA
E. T. HIBBS, *Chairman*

Local Arrangements Committee—
R. H. DAVIDSON—Ladies Program
D. M. DELONG—Banquet
J. N. KNULL—Exhibits and Displays
T. H. PARKS—Public Relations
ROY W. RINGS—Registration
CARL VENARD—Special Events
G. W. WARE—Projection Equipment
D. LYLE GOLEMAN, *Chairman*

Nominating Committee—L. K. CUTKOMP
H. H. ROSS
GEO E. GOULD, *Chairman*

Resolutions Committee—JOHN BIGGER
WM. M. ROGOFF
RAY L. JANES, *Chairman*

Auditing Committee—G. E. GUYER
W. R. ENNS, *Chairman*

Membership Committee—ROBERT E. BEER
RALPH H. DAVIDSON
JOHN A. LOFGREN
H. B. PETTY, *Chairman*

Sustaining Associates Committee—
WAYNE J. COLBERG
HARLAN R. SHUYLER
GEORGE B. WAGNER
E. H. FISHER, *Chairman*

Recording Committee—C. W. WINGO
RAY T. EVERLY, *Chairman*

Respectfully submitted,
CURTIS W. WINGO
Secretary-Treasurer

ALL INCLUSIVE BIOLOGICAL SOLIDARITY

By FRANK L. CAMPBELL

What do the initials AIBS mean to entomologists? Few would flunk that question today. The answer is American Institute of Biological Sciences, the most promising attempt ever made to attain All Inclusive Biological Solidarity.

The report of the Glen Committee, which was published in the March issue of the BULLETIN OF THE ENTOMOLOGICAL SOCIETY OF AMERICA (pp. 26–28), recommends "that the Entomological Society of America apply for full membership in the American Institute of Biological Sciences." The reasons for this recommendation are given with great clarity and cogency and should be reread by every member of ESA before voting on this question. Only the last and most important will be repeated here; namely, "to secure

the privilege of participating in a national effort in the interests of the whole science of biology and on behalf of all biologists."

The above recommendation was enthusiastically accepted by the Governing Board, and if the question had been put to a vote at the final business meeting of the Society in Memphis, ESA would now be a member of AIBS, so overwhelming was the favorable sentiment at that meeting. However, the question was of "major importance," equivalent to an amendment of the Constitution or By-laws that "shall be referred by mail ballot to the entire membership." Moreover, the Glen Committee recommended "that the Governing Board of the Society seek approval of its support of the above recommendation through a vote of the entire membership of the Society." This is being done, even though action at the annual meeting alone would have been legally defensible. One wonders, however, whether those who were not present at Memphis can be caused to catch the enthusiasm generated by Bob Glen and his report, and by Hiden Cox, the Executive Director of AIBS, and his speech on the functions and activities of the Institute.

The present minimum dues required by AIBS for a society of more than 1000 members is $1,000 per year. Lest it be a financial hardship for AIBS to accept ESA and deliver the *AIBS Bulletin* to each of its members for such a small sum, the Glen Committee recommended an annual payment of more than $1,000; i.e., $1.00 per member per year, or more than $4,000. However, the Board is not likely to approve such a voluntary overpayment. Therefore, the initial cost to each member of ESA for his society's membership in AIBS would probably be less than 25 cents per year. Sooner, or later, however, AIBS must make the annual dues of a member society, regardless of size, directly proportional to the number of its members.

Would membership of ESA in AIBS reduce in any way the importance of ESA? The Glen Committee was sensitive to this question, examined it objectively, and reported, "In the opinion of the Committee, the Institute has amply demonstrated its capacity to preserve the integrity of its member societies while contributing to the welfare of biology in general." An excellent example of such action occurred not long after the Memphis meeting. Every entomologist employed by the U. S. Government knows that the Civil Service Commission gave a salary advantage to certain physical scientists because of an alleged difference in demand for physical and biological scientists. AIBS immediately rose to the defense of biology. Many letters of protest were written to high government officials, and the Civil Service Commission was caused to reexamine its action. (If you, the reader of this paragraph, had been a member of AIBS through ESA, you would already know what steps were taken by AIBS to correct this injustice, for the story was told by Dr. Cox on page 11 of the January 1958 *AIBS Bulletin*). Later the AIBS office was able to provide the Civil Service Commission with pertinent statistical information from the Register of Scientific and Technical Personnel regarding relative salary trends of biologists inside and outside of Government Service. At the same time AIBS has insisted that salary discrimination based on alleged differences in demand for different kinds of scientists is unsound and unwise. A decision by the Civil Service Commission on the question at issue will probably have been made before these words are published.

AIBS has also shown its awareness of the part that biology ought to play in current scientific and technical developments and has displayed vigorous initiative in getting attention for biology. For example, AIBS probably caused the U. S. National Committee for the International Geophysical Year to appreciate the possibilities for biological research in the IGY polar stations, and biology is now included in plans being made for polar research after IGY. AIBS was first to propose "a symposium on biology in the space age" and jointly with NAS-NRC and NSF is sponsoring a symposium in May on "Possible Uses of Earth Satellites in Life Science Experiments", at which entomologists will be present.

More and more, one may expect AIBS to be a dependable source of information about pending legislation affecting its member societies. With the aid of legal counsel, AIBS will interpret such legislation and advise on its significance. Conversely, AIBS is serving more and more as a center of information for committees of Congress concerned in some way about biology.

Soon a great expansion in the work of AIBS in biological education is expected. The Board has authorized a program similar to the well-known Zacharias program in physics. Thorough studies of biological curricula in high-school and first-year college are planned. A special program has been designed to produce two experimental teaching films; one on meiosis, the other on evolution.

Expansion of other activities mentioned in the report of the Glen Committee are imminent, among them the translation into English of a Russian journal of entomology, and the extension of the college visitors' program to high schools. It is easy to see where entomology fits into any activity called biology above and that entomology ought to be participating.

Now for the vote! A vote for joining AIBS is a vote of confidence in the strength and usefullness of a federation of national biological societies and in the ability of entomology and entomologists to play an important role in that union. Without ESA, one of the largest and most important of the national biological societies, AIBS is crippled; with ESA nothing can stop AIBS in its advance toward All Inclusive Biological Solidarity!

REPORT OF THE COMMITTEE ON PROFESSIONAL TRAINING, STANDARDS AND STATUS

Reference is made to the entry under the above heading on page 16 of the March 1958 BULLETIN. Herewith is the condensed version of the committee report there mentioned.

ENTOMOLOGY AND PROFESSIONALISM

INTRODUCTION

During the past decade, American entomologists have been giving an increasing amount of attention to the problem of professionalism, a development which is undoubtedly but further evidence of an evolutionary trend long apparent in the traditional professions, such as medicine, law, and engineering, and now beginning to make itself felt within the American scientific society.

The need by American entomologists for acknowledging this development with some sort of response finally expressed itself in the appointment, in 1955, of the *Committee on Professional Status and Standards*, established with nine members[1], and instructed to report its findings and recommendations to the Governing Board of the Entomological Society of America on or before November 1, 1955. This temporary Committee was charged specifically with (1) investigating the accrediting of educational institutions by other professional groups and the propriety of adopting such procedures for the Entomological Society of America, and (2) investigating matters dealing with professional status and standards in so far as the Society is concerned. This Committee evolved much able thinking on both the philosophical and pragmatical sides of the question of professionalism, thinking which has been borrowed from freely for the purposes of this report. However, it was found impossible to develop a majority report prior to the Annual Meetings of the Society in 1955 and so the Committee was disbanded shortly thereafter.

The work of this Committee had a further value, however, in that it resulted in the establishment by the Governing Board at the New York Meetings of 1956 of a new standing committee, the *Committee on Professional Training, Standards, and Status;* with a membership of six, to serve for three year terms on a rotating basis. This new Committee was charged with the responsibility for

[1] T. R. Hansberry, E. F. Knipling, C. D. Michener, W. C. O'Kane, W. D. Reed, S. W. Simmons, L. M. Smith, R. L. Wenzel, and A. C. Hodson, Chairman.

providing long-range guidance to the Society in matters relating to professional training, standards, and status for entomologists, and to serve as the medium through which needed improvements in these matters could be officially initiated.

The above statements should not be construed to mean that all expressed interest in the professional aspects of entomology began with the year 1955. To the contrary, a perusal of the publications of the Entomological Society of America and of its ancestral organizations discloses a number of published statements dealing with the subject of professionalism. (For examples, see the following: J. Eco. Ent. 30:974–978, 1937; Ibid. 37:320–321, 1944; Ibid. 38:131–132 and 737–738, 1945; and Bull. Ent. Soc. Amer. 1 (1): 16–18, 1955).

Definitions

Many of the terms necessary to a discussion of the problem at hand have come to have connotations somewhat out of line with accepted dictionary definitions. This in turn has sometimes resulted in a misinterpretation of what has been said. Accordingly, to provide the greatest possible measure of stability in this respect, the terms which are essential to this discussion and which lend themselves to varied interpretations are defined below in the sense in which they are being used.

Profession. Profession is used here in a restricted sense to mean a vocation which requires a specialized academic background of its participants. Many professions are based upon specific sciences and in that case can properly be termed "scientific professions." This definition of profession is specifically worded to exclude those vocations which can be entered following a period of apprenticeship, since very few of the so-called "learned professions" are any longer amenable to this method.

Professional. A professional is one who can do independent, *creative*, occupational tasks without supervision; in line with the definition of profession given above, a prerequisite for the attainment of this proficiency is training in an educational institution (modified from a definition given by S. B. Freeborn, Bull. Ent. Soc. Amer. 2(4):23–24. 1956).

Professionalism. This term is used in a broad sense to include all features characteristic of, or peculiar to, a profession (as defined above).

Professional Standards. Professional standards are conceived to be specified minimal levels of didactic training and performance capability required of an individual by a profession before it recognizes him as a member, and collectively so designed as to insure an ultimate improvement in the general level of professional practice (J. Eco. Ent. 49:572. 1956).

Professional Status. Professional status is used when considering the degree of acceptance of a professional individual or of a profession by other professions or by the general public. The acceptability of an individual by his own profession is also considered here.

The Problem

As pointed out earlier, this Committee is charged with the responsibility for providing guidance to the Society in matters relating to professional training, standards, and status of entomologists. As can be readily appreciated, a tremendous scope of potential future action is contained within this simple statement of assignment and a problem immediately presents itself of where to begin to carry it out. Probably the biggest single problem is to develop a modern philosophy and a subsequent implementation that not only will solve in due time the professional problems confronting entomologists, but will also be sufficiently acceptable to the membership and to the times in which we live to permit constructive action.

In considering where to begin, it would seem that perhaps the derivation of *professional standards* should receive first consideration, since such an action would be tantamount to developing a definition of a professional entomologist. Following this line of reasoning, the next step would be to give consideration to entomological curricula (*professional training*), since professional standards must inevitably be based, at least in large part, on academic training. And last, with the development of appropriate professional standards and of suitable training, an improvement in the *professional status* of entomology should eventually result. The remaining portion of this report is developed in line with the sequence of events described above. Lest the above statement of approach be interpreted to mean that professionalism can be gained solely through the use of devices, such as standards, curricula, accreditation, certification, licensure, and codified ethics, this Committee desires to make clear that it believes there to be no substitute for exemplary individual conduct, meritorious work, and dedicated service as a route to professional status.

Professional Standards

If frequency of mention is any criterion, professional standards constitute the phase of professionalism of most interest to entomologists at the present time. This is quite logical when one considers that the establishment of definite professional standards for entomology will undoubtedly also result in material gains for entomologists. Also, as pointed out in the introduction, it is believed that this subject is basic to the entire subject of professionalism.

Basis of Need. Why is there a need for professional standards? Perhaps the purest motive for having them lies in the belief that professional standards will improve the study of entomology as a science and the practice of entomology as a skill. From this concept it is but a logical step to the belief that such improvement will result in a higher regard by the public and by other professions for entomology and for entomologists, which in turn should lead to greater professional opportunity and personal emolument. Acceptance by others of one's mode of employment is well known to be an exceptionally strong motive behind human endeavor, and in many cases exercises an even stronger force than does the desire for increased material remuneration.

Values to be Realized. The specific values to be received from the development of professional standards should be carefully considered, if planning is to be securely founded. It is believed that from the above statement of motive the following values can be expected, and that furthermore they constitute cogent arguments for the establishment of professional standards:

a. Certainly the most basic reason for setting up professional standards for entomologists is to effect an ultimate improvement of the science of entomology. In other words, the higher the requirement for training and experience on the part of the individuals charged with the conduct of the study and practice of entomology, the better the average performance of entomologists as a group should become. This in turn will of course benefit entomology as a science. Here, it must be granted that the erection of standards will not materially effect the performance of the great number of entomologists already devoting themselves unstintingly to the study or practice of their science, but it will improve the level of accomplishment of those to come.

b. The establishment of standards will have a salutary effect upon the quality of entomological training available in the United States. Here again, one must grant that improvement will be on an "average basis" since a number of entomological training centers are already operating at peak performance.

c. The possession of professional standards would increase individual professional status by making it possible for all interested outside agencies to determine who in the eyes of their own colleagues are qualified and competent in the field of entomology. The lack of this type of status is one of the most frequently heard complaints today.

d. An increase in the professional status of entomology

as a whole would result, due to better average performance on the part of entomologists as a group.

e. Better professional opportunities would certainly result. Today, prospective employers of entomologists are forced to derive their own concepts of what constitutes an adequate entomologist. The erection of professional standards will eventually result in the profession determining this point and not the employer. Entomologists employed along side individuals from professions with high standards will then no longer be as subject to being given secondary consideration as they are today.

f. Only individuals qualified by training and experience as entomologists will have a voice in the determination of the policies of the Society or in the official conduct of the profession.

g. The confidence of the public in entomological services received will be strengthened.

Problems Attending Establishment of Professional Standards. Granting for the sake of discussion that the establishment of professional standards is desirable, what will be the effect of such a movement on the present Entomological Society of America, keeping in mind the diverse and varied composition of the Society? Can this objective be accomplished without creating a ground swell of dissension that might tend to divide our ranks once again? There is little question that at all costs the "Union must be preserved" and that the road to adequate professional standards must therefore be traveled with considerable caution.

At the present time many individuals can qualify for the title of "entomologist" as defined by the Constitution of the Entomological Society of America, namely one who has an interest in entomology. There are a number of crafts, trades and professions which deal with insect problems in a skilled way: pest control operators, aerial sprayers, insecticide formulators, chemists, plant breeders, geneticists, writers and administrators to name only a few. All of these can and do make real contributions to the science of entomology by bringing to it a background in a related field. However, it is doubtful if they basically feel or expect full responsibility or recognition as professional entomologists, and it is believed as long as they can continue to be affiliated with the Society that they will interpose little or no objection to the establishment of professional standards for entomology.

Plans for establishing professional standards will inevitably cause concern on the part of recognized entomologists who lack formal training in the field. Accordingly, any plan developed must contain a "grandfather's clause" which grants fullest privileges to all present Active Members.

Another problem is the speed at which the establishment of professional standards should be accomplished. An all-at-once transition is obviously not desirable, and so any program devised should be long range in scope with increments of the plan being phased in at intervals over an extended period of years.

A problem which was in part responsible for the failure of the scheme for professional standards attempted by the former American Association of Economic Entomologists is that of "forgotten men" or individuals who were not advanced to the next higher level of membership when they became eligible. However, this is essentially a problem of administration and shouldn't really be troublesome under any well-conceived plan.

It is believed that the first and most practical approach to the development of professional standards is to draft a revision to the Constitution of the Society which requires more than a simple expression of interest in insects for full participation in Society affairs. In this advanced age, it would not seem out of line to require all *new* Active Members to have a bachelor's degree from a recognized institution of higher learning. Since it is now well-accepted that specialization should not begin too early in the training of an individual it is believed inappropriate to require that this degree be in entomology, just so long as it includes a good fundamental background in a biological or related science[2]. However, a certain period of experience in the field of entomology should be required to insure that individuals without formal training beyond the baccalaureate level are actually entomologists. At the present time, it is believed adequate to permit holders of the Master's Degree to become new Active Members with a lesser amount of experience than is required of Bachelors, and for Ph.D's to become such without experience, provided these degrees are in entomology. Associate Membership Status should be provided for those individuals who qualify in all respects except for possessing the required experience. Elevation from Associate Member to Active Member should probably be by request of the individual (accompanied by his credentials).

In order to retain the active affiliations of specialists from other disciplines, of individuals employed in applied phases of entomology but without professional training in entomology, and of the frequent dedicated individual who contributes to entomology solely from an inborn inquisitive nature, it is recommended that an Affiliate Membership status be established requiring only a certain number of demonstrable years of activity or interest in entomology.

Certification. A procedure which has been rather frequently employed as a means of specially delineating the so-called "hard core of professionals" of a group is that of "certification." Within the professions (as defined earlier) where the procedure of certification is employed, precedence has established the practice of an agency other than the society itself doing the actual certification. For example, the members of the American Medical Association are certified by the various "speciality boards;" the American Board of Clinical Chemists acts in this capacity for the American Chemical Society, the Institute of Chemists, and the American Society of Biochemists; and the newly established American Academy of Microbiology serves as a certifying body for the Society of American Bacteriology. In each case the certifying body is incorporated under the laws of one of the states and pays the cost of maintaining groups of examiners by charging sizeable entrance fees. In general, it is the purpose of certification boards to attempt to elevate and establish standards and to advance the science of their specialty by issuing certificates of special knowledge to voluntary applicants who in accordance with the regulations of the board have established their fitness and competence.

A system of certification could be similarly established for individuals belonging to those segments of the Entomological Society of America most strongly feeling the need for a high level of professional status. For example, it is believed that such a need particularly exists in the subspecialty of medical and veterinary entomology, since individuals employed in this field customarily work beside physicians, veterinarians, and sanitary engineers, all members of groups with exacting requirements for practice.

However, regardless of this possible need, a certification program is not recommended for American entomologists at this time. A principal reason for not advocating certification at this time is the belief that the need for it is not yet sufficient to support the considerable expense connected with the establishment and maintenance of a board. However, knowing that several Societies have recently embarked upon a certification program, it is the recommendation of the Committee that the Entomological Society of America continue a study of this type of a procedure, paying particular attention to how it works out elsewhere and perhaps eventually canvassing the membership to determine how great a need there is for certification within our own profession.

Licensure. Should entomologists be licensed? Most professional groups in which the members are licensed to practice are responsible to the public for its general

[2] Once minimal standards for undergraduate training are developed, it may become appropriate to modify this concept.

welfare, and the members receive compensation for the services provided in the form of a fee. Among societies with professional standards and with an active program for the improvement of training, the American Chemical Society and the Society of American Foresters do not have licensing of their professionals as an integral part of their professional program. Recently there has been a move in two states to set up laws governing the licensing of professional foresters which apply particularly to the very small minority who become consulting foresters. The members of the American Chemical Society have recently voted down a proposal to license chemists by a surprisingly large majority. On the other hand, groups such as the engineers, architects, pharmacists, and physicians, whose members are commonly dealing directly with the public, have found that it has been very much to their advantage to have licensing of their members a requirement for professional employment. When a national or state licensing board exists, these men usually are empowered under the law to require a candidate to hold a diploma from an accredited institution. If the professional society sets up the standards used by such a board, as is usually the case, the society gains control over the profession. It can limit the number of men in the profession by limiting the number of accredited training institutions, and it can limit the number of graduates from each of the accredited institutions. This latter is done by the accrediting committee of the professional society, which visits the school and determines the number of students which can be adequately trained with the existing facilities and staff.

In the case of entomology, a licensing procedure might be indicated for branches of the profession which deal directly as individuals with the public, such as pest control operators and spraying contractors. However, it is felt that this is a problem of the specific groups involved and is not yet a problem for the Society as a whole. Furthermore, the groups involved are already making good progress in raising their standards in many parts of the country. If at any time it should be indicated or desired, the Society could make available its services in a consultative capacity to groups engaged in entomological practice, or might serve as an advisory body to the states on matters of legislation connected with licensing procedures. However, it is not recommended that the Society go beyond that point at the present time.

Code of Ethics

Another problem relating to the assignment of this Committee, is whether or not the Society should develop a code of ethics for entomologists, i.e. outline the standards for professional practice as distinct from training and membership standards. Here again it is believed that no immediate action is indicated, since if a need exists, it is probably on the part of those groups within the profession who are directly serving the public. Professional entomologists at large, including individuals working in the fields of taxonomy, teaching, industry, pest control, and experiment station agriculture have such diverse practices that it would be difficult to write a code which would concisely apply to all. Eventually, however, this will undoubtedly be a desirable step to take.

Training

No program of professional improvement can go far without getting deeply into the problem of training. The subject of the training of a professional entomologist has recently been most appropriately treated by Dr. S. B. Freeborn (Bull. Ent. Soc. Amer. 2(4):23–24. 1956). From a consideration of Dr. Freeborn's comments and from an examination of the work being done by many other professional organizations in this field, it becomes apparent that a tremendous and highly complicated problem is involved here. Included within the problem is the determination of what minimal training is necessary to make an adequate entomologist at the baccalaureate level, the problem of graduate school requirements, and the problem of the accreditation of institutions providing entomological training.

Baccalaureate Level Training. At the present time the possession of a degree at the baccalaureate level with training in entomology is the sole requirement for a fairly large segment of American employment of entomologists. Since these individuals thereupon become designated as entomologists, it behooves the entomological profession as a whole to concern itself with the question of what constitutes adequate basic training for individuals seeking employment following graduation at the baccalaureate level in entomology.

It is immediately apparent that if all entomological employment occurred at the baddalaureate level, there would be relatively little difficulty in developing a recommended academic curriculum for entomologists-to-be. However, the fact that a fairly large number of individuals later take up graduate studies complicates the problem considerably. In view of this latter situation, either a very general curriculum should be recommended, or else two must be made available. One would be a "trade school type" curriculum which would give sufficient courses in entomology to permit an individual to go to work immediately upon graduation, and the other would provide a training generalized enough to permit the individual to enter graduate school.

This raises the issue of whether or not all of the necessary liberal arts and science courses necessary to modern man be given within a four year period, plus sufficient hours in entomology, to permit the individual to take up at the end of that time any type of entomological employment where a higher degree is not a prerequisite? Judging from trends observed in some of the universities, the answer to this question is No. Perhaps, then the solution is to have a "pre-entomological curriculum" (in line with premedical curricula), the first three college years for instance and broadly rounded enough to permit the individual at the end of the fourth year to go into any one of a number of biological specialties, including entomology. Should the individual elect entomology at the beginning of his fourth year, then he would be given sufficient entomological courses during that year to be eligible for baccalaureate level employment upon graduation. At the same time he would be sufficiently well-trained to enter graduate school.

Can this be accomplished? It is believed that some academic centers would answer No and state that such individuals would not receive sufficient basic entomological training to be either good entomological practitioners or to be eligible for graduate school entrance. However, these points all need to be determined.

Perhaps one answer is to require a general curriculum for the entire four years of undergraduate school and then to recommend one year of graduate school as a prerequisite requirement for employment under the title of "entomologist."

Dr. Freeborn, in his discussion of the training for a professional entomologist, elects for a broad preparation in the basic natural and physical sciences and the liberal arts, topped with a thorough indoctrination in the basic elements of entomology. His "prescription" for the latter consists of five courses: general entomology, advanced taxonomy, combined insect anatomy and physiology, insect ecology, and summer practice. For those individuals planning to enter business, he would recommend economic entomology as an additional course.

This discussion might be carried on interminably, but the foregoing is sufficient to demonstrate that a complicated problem exists here which must receive considerable study before any adequate solution can be evolved.

Accreditation

Once professional standards are developed which establish as a prerequisite for membership within the profession certain specified academic attainments, the question arises as to whether or not all academic institutions are giving training of comparable value. To provide an answer to

this question, a number of professions have established standards for evaluating the quality and quantity of instruction given in their specialty. In some cases, professions have even gone a step further and established an accrediting committee which is charged with determining which institutions actually meet these standards. Members of the accrediting committee may be called upon to make on-the-site inspections of facilities and staff, or accrediting agencies may be employed to perform the task of inspection and evaluation. As another approach to this problem, the Society of American Foresters cooperates with regional accrediting groups by accepting their evaluation of colleges or universities in which a forestry program is given. In this case a member of the Society works with the accrediting group and the Society reserves the right to turn down a department of forestry even though the school, as a whole, is rated high by the accrediting agency. However the mechanics are worked out, accrediting serves the purpose of making known those institutions that meet the standards established by the profession. It also provides a lever for heads of departments to use in prying staff and facilities out of the school budget in order to qualify as an accredited department.

Many professional societies have not taken on the responsibility and cost of accreditation. For example, the Society of American Bacteriologists and the Wildlife Society have carefully considered accrediting professional schools and have finally decided not to attempt it. As an alternative line of action, the Committee on Professional Standards for the Wildlife Society recommended that a committee composed of wildlife administrators and college professors be established to review the various research, administrative and operational phases of the wildlife field, determine the qualifications and types of personnel needed to handle the respective jobs and then attempt to improve training, where necessary, through mutually agreeable cooperative means.

A Plan

It is felt that the first step to take in connection with training is to determine the desirable minimum of training required of entomological graduates at the baccalaureate level. It is felt that this can most readily be accomplished by the submission of an appropriate questionnaire to all institutions of higher learning in the United States where training in entomology is provided. From the data so obtained a point could be selected at about the median of the requirements found to be already in existence and set up as "minimum standards for undergraduate training in entomology." These minimum standards should, following receipt of official approval of the Society, then be sent to all concerned institutions of higher learning, and to all members of the Entomological Society of America with the statement that they represent the recommendation of the Society. Following this, it would seem appropriate for the Society to prepare a list of schools known to meet the minimum standards. It is believed that any form of accreditation beyond this point is not appropriate for the Society at this time.

Meanwhile, in connection with the proposed constitutional change calling for a Bachelor's Degree as the minimal academic requirement for membership in the ESA, it is believed adequate to require this training to have been accomplished at an institution accredited by a national or regional accrediting association. This could then be modified at a later date to conform with any actions taken following the establishment of minimum standards.

Professional Status

One of the reasons that many individuals keenly feel the need for professional standards is that they also have the feeling that the profession of entomology has a rather low status in the opinions of other professionals, particularly those belonging to highly organized groups such as physicians and engineers.

Frankly, it is not believed that entomology is without status. Furthermore, it is not believed that the attitudes of professionals who sell their services directly to the public should be considered too greatly in evaluating the status of entomoogy, since entomology is hardly comparable to them. In other words, we should not be concerned if we are not treated like lawyers or doctors, but rather whether or not we are treated like chemists, bacteriologists, physicists, and botanists, to name a few. If, in contrast to any of these groups, entomologists are not receiving ratings or salaries commensurate to the amount and kind of training and experience held, then they do have something with which to be concerned. Presently, the treatment accorded entomologists differs little from that accorded the members of other related sciences.

Something that does need concern us, however, is that all too frequently the agencies which employ entomologists and other scientists feel that they are dealing with a professional on a different level than a member of a highly organized group with stiff membership requirements, and as a result, offer them lower salaries and lesser ratings than they do to these latter groups. It will be necessary for entomologists to define their profession in appropriate terms if this is to be corrected. As an example here, consider treatment given to entomology by the U. S. Civil Service Commission. At present, the "Entomology Series" is limited to research, and only four major specializations are recognized. By comparison, the "Agronomy Series" has eleven major specializations. When government agencies employ entomologists for work not strictly in the field of research, it becomes necessary to use non-entomological designations such as "Agriculturist".

Fellows

A device frequently used by scientific societies and related professional groups for increasing professional status is the establishment of a membership classification of "fellows" as a mark of recognition of outstanding merit. Provided the procedures for selecting new fellows are wisely devised, this is a very effective way of improving the professional status of individuals. The former Entomological Society of America had this membership classification, and its adoption by the present Society is recommended.

Note: The Committee received specific authorization from the Governing Board at Memphis to begin in 1958 a study of curricula leading to the award of the Bachelor's Degree by students specializing in entomology, with the purpose in mind of preparing from the collected data "minimum standards for undergraduate training in entomology." Authorization was also given to undertake a study of present State and Federal Civil Service standards for the employment of entomologists.

Respectfully submitted,
C. E. Palm
Eugene Gerberg
R. E. Heal
C. F. Smith
L. M. Smith
K. L. Knight, *Chairman*

PROGRAM COMMITTEE

Please note *Program Highlights* elsewhere in this issue of the Bulletin. The deadline for submission of titles and abstracts of papers for the Salt Lake City meeting is September 1. This is a permanent annual deadline date and should be indicated on your calendar.

The 1958 *Program Committee* was listed with other Standing Committees on page 33 of the March 1958 Bulletin. There is a transposition of expiration dates as printed there and the committee is restated properly below.

E. H. Smith, Geneva, New York.....(1960)
E. N. Woodbury, Wilmington, Delaware.....(1958)
L. D. Anderson, *Chairman*, Riverside, California...(1959)

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AMERICAN MOSQUITO CONTROL ASSOCIATION

The A.M.C.A. met on February 23–26, 1958 at the Willard Hotel in Washington, D. C. At the request of President Metcalf, the Executive Secretary of the Entomological Society of America attended as an official delegate. The program, exhibits and meeting arrangements were excellent. A complete report will be presented at a later date. The following is of interest at this time.

Commander J. M. Hirst was elected President of the Association, and Dr. A. D. Hess President-Elect. These officers are members of the Entomological Society of America and congratulations are extended.

Among the resolutions adopted at the final business session was the following:

RESOLUTION NUMBER 3

Whereas the attention of the American Mosquito Control Association has been called to the growing concern of certain wildlife conservation groups and individuals relating to the widespread employment of insecticides for agriculture, forest and pest control; and

Whereas mosquito control, as practiced by the member agencies of the American Mosquito Control Association and the several State Mosquito Abatement Associations is conscientiously conducted in appreciation of the values of wildlife to the overall economy and in accordance with an understanding of the fundamentals of wildlife management and conservation: Now therefore be it

Resolved, That the American Mosquito Control Association extend to its membership the recommendation that in the planning and conducting of mosquito control operations in areas of concern to wildlife, due consideration continue to be given to the wildlife factor, and that the methods of control to be applied conform, as closely as practical, to those practices acceptable to the U. S. Fish and Wildlife Service and the corresponding state wildlife agencies; and be it

Resolved further, That this Association recognizes the complex interrelationship of mosquito control and wildlife conservation and acknowledges that years of research are frequently required to fully evaluate the effects of temporarily or permanently altered habitats. However, the Association points out that years of intensive research have already been devoted to this intricate problem, which serve as the basis for current approved mosquito control practices compatible with wildlife conservation; and, the Association regrets that the public has been so poorly informed of the cooperative efforts of mosquito control and wildlife conservation agencies in seeking satisfactory solutions to these problems.

REPORT OF THE REPRESENTATIVE ON THE AAAS COUNCIL

An interim report on AAAS Council activities during 1957 was prepared by the Society's two representatives and published on page 20 of the March 1958 issue of the BULLETIN OF THE ENTOMOLOGICAL SOCIETY OF AMERICA. The retiring representative herewith reports on AAAS activities at the annual meeting of the Association in Indianapolis, Indiana, December 27–30, 1957. See also the report of the 1956 retiring representative, H. H. Ross, on page 21 of the March 1957 BULLETIN.

Owing to illness the writer was unable to attend the Council meetings at Indianapolis. Therefore the following report is based on the minutes of the meetings and contact with Council members, and includes the facts believed to be of greatest interest to our Society membership.

1. During the year the following entomologists were elected, by the Board of Directors, as fifty-year members: Annette F. Braun, A. L. Melander, W. J. Phillips, R. E. Swain, and James Zetek.

2. Voted that effective January 1, 1958, *The Scientific Monthly* will be merged with *Science* and that the combined magazine would be sent to all members of the Association and all subscribers to either journal. The combined journal will have the format of *Science*, but that much of the present character of *The Scientific Monthly* will be retained in a special monthly issue of *Science* that will be devoted largely to review articles. Advantages of the merger are that the staff will be able to concentrate on a single journal that will be better than either of its predecessors, that the Association will send the same journal to all members, and that the wasteful duplication of material that must now appear in both will be avoided.

Studies to determine the effect of the increased dues and merger of the two journals on membership, indicated that the Association suffered no material loss.

3. The Board reported on the poll of Council members regarding dues increase. A substantial majority, 268, replied, of which 234 or 87 percent voted to increase the dues from $6.50 to $8.50.

4. Committee on the Social Aspects of Science. In his report for 1956, Doctor Ross emphasized the importance of the Committee and its relation to the activities of the Entomological Society of America. Therefore, we submit the complete Council report as follows: "Dr. Chauncey D. Leake, Chairman of the Committee on the Social Aspects of Science, on behalf of the Committee submitted the following report.

At the 1955 Atlanta meeting of the AAAS, Dr. Ward Pigman proposed a program for dealing with social aspects of science. An Interim Committee was appointed to survey the matter. With Dr. Pigman as Chairman, this Committee reported at the New York 1956 meeting, with the results of the survey published in *Science* on January 25, 1957. At the New York meeting of AAAS, the Council adopted the following resolution:

> *Whereas*, one of the purposes of the AAAS is "to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress, and
> *Whereas*, the present rapid advance of science is accompanied by social problems of unprecedented magnitude that affect human welfare; therefore
> *Resolved*, that in recognition of the responsibility of scientists to participate in deliberations regarding the use made of new scientific knowledge, the Council of the AAAS authorizes the President to continue the work of this committee by appointing an enlarged group for the purpose of defining the problems, assembling the relevant facts, and suggesting a practical program, to be submitted to the AAAS Board of Directors, to implement the objectives of the AAAS in this regard.

On appointment from President Laurence H. Snyder, this Committee was organized in the spring of 1957, and has held four meetings, with Chauncey D. Leake as Chairman.

Six subcommittees have been appointed: (1) on AAAS planning with relation to social aspects of science, Ward Pigman, Chairman; (2) on authoritarianism in relation to science, Lawrence Kubie and T. C. Byerly, Co-chairmen: (3) on support and organization of scientific research and education, Charles F. Roos, Chairman; (4) on man-made problems of the physical environment, Barry Commoner, Chairman; (5) on the social effects of scientific activities, Margaret Mead, Chairman; (6) on the role of science in general education and culture, Thomas H. Osgood, Chairman; and (7) on communication with the public on scientific matters, Jack Geiger, Chairman. In addition to these chairmen of subcommittees, the general Committee includes Stuart A. Rice, Robert K. Merton, and David D. Ruthstein. The subcommittees have made preliminary surveys of the matters with which they are concerned.

As reported in the *New York Times* of November 16, the Committee considered issuing statements to the public on current social issues relating to science. After failing to agree on a satisfactory statement on radiation hazards, it was decided that such a statement might

be unwise, since it might suggest an authoritarianism which is repugnant to the ideals of scientific effort. The Committee holds that scientists are within their competence in furnishing scientific data on social problems and in suggesting the consequences of the facts as far as they are verifiable. However, scientists are probably no wiser than other intelligent citizens in reaching policy decisions on major social issues.

The Committee, therefore, at the suggestion of Dr. Paul E. Klopsteg, President-Elect, hopes to persuade private scientific groups, including the AAAS, to organize conferences on social aspects of science, the discussions of which could be reported to and reviewed for the public. One such conference, with representative speakers from competent sources, discussed radiation hazards at the Indianapolis meeting, on December 29, 1957, with wide press coverage, and with reports to be published in fuller detail. As appropriate subjects for other such conferences, the Committee suggests such social problems involving science as it has already considered: (1) the role of science in government; (2) attitudes of authoritarianism in relation to science; (3) population and nutrition problems; (4) pollution of airs and waters; (5) support of fundamental scientific research directed to the acquisition of new knowledge about ourselves and our environment; (6) science and ethics; and (7) the role of science in culture and education. Some of these subjects have already been included in symposia arranged for general meetings of the AAAS. The Committee also suggests the promotion of local neighborhood discussion groups on social aspects of science, led by local scientists, where interested citizens might learn what science is about, and why it is important that our children get early and much science training in our schools, without sacrificing humanistic studies.

These matters have been carefully considered by your Committee and also by the AAAS Board of Directors. The Board has indicated its interest in and support of the work of your Committee. The Board is aware of the growing responsibilities of scientists in regard to the social consequences of scientific progress, and is seeking appropriate ways to aid scientists in analyzing and meeting these responsibilities. The Board offers to try to find funds to help hold symposia or conferences for the purpose of exploring various features of the social impact of science, as suggested by the Committee, and in making available to the public the reports and discussions of such sessions."

5. The President announced that by mail ballot the Council had elected Paul E. Klopsteg as President-Elect and had reelected William W. Rubey and Thomas Park for four-year terms on the Board of Directors. He announced further that the Board of Directors had elected Mina S. Rees for a three-year term to fill the vacancy on the Board of Directors created by the election of Dr. Klopsteg as President-Elect.

Respectfully submitted,
J. J. Davis
Retiring E.S.A. Representative

HELIOTHIS INFORMATION EXCHANGE

A group of individuals met in Memphis, Tennessee, the morning of December 4, 1957, and discussed means of furthering the work on *Heliothis* spp. Several questions were raised, the most important of which was, "Means of exchanging data on *Heliothis* on an annual basis."

In order to achieve this objective, a National Committee consisting of one man from each district in the Entomological Society of America was elected and given the responsibility of devising better means of exchanging data concerning *Heliothis* species. The Committee, consisting of L. D. Anderson, Entomology Department, Riverside, California; F. P. Harrison, Department of Entomology, College Park, Maryland; C. R. Neiswander, Ohio Agricultural Experiment Station, Wooster, Ohio; Clyde F. Smith, Box 5215, State College, Raleigh, North Carolina, Chairman, then met and decided to try the following:

1. Contact all entomologists in North America who are working with *Heliothis* and determine whether or not they would be willing to exchange information regularly on an annual but informal basis. It is to be understood that all such information will be treated as confidential by those receiving it.

2. Prepare a list of those interested in and willing to exchange data and send the list to each individual on the list. It will then be the responsibility of each individual on the list to see that his data gets to the other members on the list. (If anyone on the list does not have the facilities for duplicating his material, he can contact a member of the committee and we will arrange to have it duplicated and distributed.)

Interested entomologists should write to Clyde F. Smith at the address given above.

MEETINGS

(For previous listings see page 5 of the December 1957, and page 38 of the March 1958 issues of the Bulletin.)

San Diego, California. El Cortez Hotel. June 25–27, 1958. The forty-second annual meeting, Pacific Branch, Entomological Society of America. Laurence S. Jones, Chairman, P.O. Box 1066, Riverside, California; H. H. Keifer, Secretary-Treasurer, 1112 Swanston Drive, Sacramento 14, California.

London, England. July 16–23, 1958. The fifteenth International Congress of Zoology. N. D. Riley, Secretary, British Museum of Natural History, Cromwell Road, London, S.W. 7, England.

Gould, Colorado. Cameron Pass 4-H Club Camp. August 10–14, 1958. The twenty-ninth annual meeting, Rocky Mountain Conference of Entomologists. W. Don Fronk, Secretary, Department of Entomology and Parasitology, University of Wyoming, Laramie, Wyoming.

Bloomington, Indiana. Indiana University. August 24–28, 1958. The ninth annual meeting, American Institute of Biological Sciences. Hiden T. Cox, Executive Director, AIBS, 2000 P Street, N.W., Washington 6, D. C.

Augusta, Georgia. Bon Air Hotel. October 29–31, 1958. The twenty-fifth annual meeting, National Agricultural Chemicals Association. J. V. Vernon, President, Niagara Chemicals Division, Food Machinery and Chemical Corp., Middleport, New York; L. S. Hitchner, Executive Secretary, N.A.C.A., 1145 19th Street, N.W., Washington 6, D. C.

Guelph, Ontario, Canada. October 29–31, 1958. The eighth annual meeting of the Entomological Society of Canada and the ninety-fifth annual meeting of the Entomological Society of Ontario. G. P. Holland, President of E.S.C., Science Service Bldg., Ottawa, Ontario; G. G. Dustan, President of E.S.O., Entomology Laboratory, Vineland Station, Ontario; W. C. Allan, Secretary of E.S.O., Ontario Agricultural College, Guelph, Ontario.

New York, N. Y. Commodore Hotel. December 8–10, 1958. (Please note dates. Changed since the December Bulletin.) The forty-fifth annual meeting, Chemical Specialties Manufacturers Association. H. W. Hamilton, Secretary, C.S.M.A., 50 East 41st Street, New York 17, N. Y.

SPECIAL REPRESENTATIVES

The following 1958 Society representatives have been appointed by President Metcalf, except as noted. Additional appointments will be printed in future issues of the Bulletin.

The Fifteenth International Congress of Zoology will be held in London, England, on July 16–23, 1958. It will be preceded, beginning July 9, by a Colloquium on Zoological Nomenclature. (See BULLETIN OF THE ENTOMOLOGICAL SOCIETY OF AMERICA, volume 3, number 4, page 6). The 1957 President, H. M. Armitage, appointed the following representatives.

C. W. Sabrosky, Washington, D. C.
J. T. Medler, Madison, Wisconsin
J. L. Gressitt Honolulu, Hawaii
R. L. Usinger, Berkeley, California

Dr. Medler has found that he will be unable to represent the Society and President Metcalf has chosen C. B. Philip, Hamilton, Montana, in his place.

G. J. Haeussler, Beltsville, Maryland, society representative on the *AAAS Vegetable Research Award Committee.* This continuing appointment was made by the 1957 President, H. M. Armitage.

R. H. Nelson, Washington, D. C., to the American Mosquito Control Association, fourteenth annual meeting, Washington, D. C., February 23–26, 1958.

Paul A. Dahm, Ames, Iowa, to the Centenniel of the founding of Iowa State College, Ames, Iowa, March 22–25, 1958.

J. J. Davis, Lafayette, Indiana, to the Second International Pest Control Operators Congress, Vienna, Austria, May 14–18, 1958.

SPECIAL COMMITTEES

The Standing Committees of the Society, that is those which are listed in the Constitution and By-Laws, may be found on pages 33 and 34 of the March 1958 BULLETIN. President Metcalf has appointed the following Special Committees for 1958.

Committee on Local Arrangements—Salt Lake City meeting

H. E. Dorst, Logan, Utah
A. D. Hess, Logan, Utah
D. E. Parker, Ogden, Utah
D. M. Rees, Salt Lake City, Utah
A. L. Stark, Salt Lake City, Utah
V. M. Tanner, Provo, Utah
H. F. Thornley, Logan, Utah
S. L. Wood, Provo, Utah
G. F. Knowlton, *Chairman*, Logan, Utah

Committee on Ladies Entertainment—Salt Lake City meeting

Mrs. H. E. Dorst, Logan, Utah
Mrs. A. D. Hess, Logan, Utah
Mrs. D. E. Parker, Ogden, Utah
Mrs. D. M. Rees, Salt Lake City, Utah
Mrs. A. L. Stark, Salt Lake City, Utah
Mrs. V. M. Tanner, Provo, Utah
Mrs. H. F. Thornley, Logan, Utah
Mrs. S. L. Wood, Provo, Utah
Mrs. G. F. Knowlton, *Chairman*, Logan, Utah

Committee on Exhibits—Salt Lake City meeting

G. F. Edmunds, Salt Lake City, Utah
H. L. Haynes, New York, N. Y.
H. B. Jones, Memphis, Tennessee
D. F. Martin, Brownsville, Texas
W. M. Rogoff, Brookings, South Dakota
A. D. Hess, *Chairman*, Logan, Utah

Committee on Publicity—Salt Lake City meeting

D. G. Hall, Washington, D. C.
G. F. Knowlton, Logan, Utah
E. H. Littooy, *Chairman*, Sausalito, California

Committee on Public Relations and Welfare

A. M. Boyce, Riverside, California
M. D. Farrar, Clemson, South Carolina
H. M. Harris, Ames, Iowa
B. B. Pepper, New Brunswick, New Jersey
G. C. Decker, *Chairman*, Urbana, Illinois

Committee on Memorial Lectures

R. C. Bushland, Kerrville, Texas
H. G. Johnston, Memphis, Tennessee
H. H. Ross, Urbana, Illinois
E. H. Smith, Geneva, New York
C. B. Philip, *Chairman*, Hamilton, Montana

Committee on Microcard Publication

G. E. Bohart, Beltsville, Maryland
F. W. Poos, Washington, D. C.
F. L. Campbell, *Chairman*, Washington, D. C.

Committee on Miscellaneous Publications in Entomology

L. E. Chadwick, Urbana, Illinois
P. W. Oman, Beltsville, Maryland
K. L. Knight, *Chairman*, Washington, D. C.

Committee on Losses Caused by Insects

(Reappointed from 1957)
W. G. Eden, Auburn, Alabama
J. C. Gaines, College Station, Texas
L. G. K. Iverson, Arlington, Virginia
W. E. McCauley, Scarsdale, New York
J. E. Swift, Berkeley, California
H. M. Harris, *Chairman*, Ames, Iowa

NECROLOGY

BARE, ORLANDO S. 67. Economic entomologist and teacher. In the hospital at Lincoln, Nebraska, March 31, 1958.

BEINHART, ERNEST G. 71. Tobacco technologist. At his home in Wyndmoor, Pennsylvania, March 12, 1958.

BUCHANAN, L. L. 64. Retired entomologist, specialist in Rhynchophora. In Washington, D. C., February 15, 1958.

BURKHOLDER, C. L. 65. Horticulturist and economic entomologist. In Sturgis, Kentucky, December 29, 1957.

KATZMAN, MORRIS. 52. Commercial entomologist. In Los Nietos, California, August 29, 1957.

ERRATA

The Membership List of the Society was published in the December 1957 issue of the BULLETIN. With more than 4000 members it is not possible to keep the list current. We do, however, wish to correct certain errors which have come to our attention and request that you correct your copy accordingly.

Page 9, column 1, name 21, spelling error, should read as follows:
BALCH, R. E., Forest Biology Laboratory, College Hill, Fredericton, N.B., Canada.

Page 11, column 1, omission. Insert after name 8.
BIJJANI, GEORGE Y., The College of Emporia, Emporia, Kansas.

Page 24, column 2, name 26, state name incorrect, should read as follows.
GRAHAM, LEWIS T., SLI, Box 403, Lafayette, Louisiana.

Page 28, column 1, omission. Insert after name 8.
HOFF, C. CLAYTON, Department of Biology, University of New Mexico, Albuquerque, N. M.

Page 32, column 1, name 10, delete Jr. Read as follows.
KNOWLTON, GEORGE F., Utah State University, Logan, Utah.

Page 40, column 2, name 32, spelling error, should read as follows.
OZBURN, REGINALD H., Department of Entomology, Ontario Agricultural College, Guelph, Ontario, Canada.

Page 45, column 2, omission. Insert after name 23.
RUSSELL, MATTHEW, 186 Park Drive, Longmeadow 6, Massachusetts.

BOOK REVIEWS

ANNUAL REVIEW OF ENTOMOLOGY, VOL. 3, 1958. Editor, Edward A. Steinhaus, University of California, Associate Editor, Ray F. Smith, University of California. 8vo., cloth, 520 pp., Palo Alto, California, Annual Reviews, Inc., 1958. $7.00.

Specialists in the various branches of entomology have prepared authoritative and scholarly reviews of their various specialties for this volume. It is certain that this will be given the same warm welcome accorded those previously issued because it possesses the same outstanding usefulness. The very definite need for a reference work of this particular type was long realized by all of us who had to struggle with the widely scattered literature of entomology. There had not existed anywhere a work of its exact scope. So, in 1953, a Committee of the Entomological Society of America was appointed to examine the problem of providing adequate reviews of entomological literature, and, after exhaustive study, it recommended that such needs probably would be best met by a review publication of the general type of those published by the nonprofit organization, Annual Reviews, Inc., which since 1931, has devoted itself to the publication year by year of critical reviews designed to cover systematically the current literature in certain major fields of science, in which the problems were similar to those of the entomologists. After appropriate investigations and appraisal the work was started in 1956 co-operatively between Annual Reviews, Inc., and the Entomological Society of America. The main objective was publication of authoritative and concise treatments of definitive subjects of current interest. As would be expected the more active fields of research require critical reviews annually, while the less active need to be summarized and evaluated as developments require. Also, by presenting divergent viewpoints in successive years, well rounded treatment of a given subject eventually should be attained. Now that a three year start has been made—now that the ice definitely has been broken—it is easy to visualize that each succeeding volume of this series will average up gradually better in every way than those before. Minor flaws will be eliminated, the scope of the plan as a whole will gain steadily in practical utility and in wider usefulness.

A review of Volume 1, of this series was published in the BULLETIN OF THE ENTOMOLOGICAL SOCIETY OF AMERICA, 2:27–29, 1956, and of Volume 2, in the JOURNAL OF ECONOMIC ENTOMOLOGY, 50:377, 1957. Some idea of the scope, the subjects, and the selection of authorships may be gained by enumeration of the 23 papers making up the newly issued Volume 3 of the series. These are as follows: "The Nervous System," by K. D. Roeder, Tufts University, Medford, Mass. 18 pp., 105 refs.; "Chemoreception in Arthropods," by E. S. Hodgson, Columbia University, N. Y. 18 pp., illus., 75 refs.; "Internal Symbiosis in Insects," by A. G. Richards and M. A. Brooks, University of Minnesota, St. Paul 20. pp., 83 refs.; "Nutritional Requirements of Phytophagous Insects," by W. G. Friend, Canada Department of Agriculture, Ottawa, Ontario. 18 pp., 118 refs.; "Recent Advances in Silkworm Nutrition," by J. M. Legay, Institut National de la Recherche Agronomique, France. 12 pp., 84 refs.; "Uses of Sounds by Insects," by H. Frings and M. Frings, Pennsylvania State University, University Park, Pa., 19 pp., 137 refs.; "Dynamics of Insect Populations," by A. J. Nicholson, Commonwealth Research Organization, Canberra, Australia. 29 pp., 27 refs.; "Ovarian Structure and Vitellogenesis in Insects," by P. F. Bonhag, University of California, Berkeley. 23 pp., illus., 104 refs.; "Genetics and Breeding of the Honey Bee," by W. C. Rothenbuhler, Iowa State College, Ames. 19 pp., illus., 129 refs.; "Phylogeny of the Panorpoid Orders," by H. E. Hinton, University of Bristol, England. 25 pp., 64 refs.; "Zoogeography of Insects," by J. L. Gressitt, Bishop Museum, Honolulu, Hawaii. 24 pp., 209 refs.; "Hybridization and Speciation in Mosquitoes," by L. E. Rozeboom, Johns Hopkins University, Baltimore, and J. B. Kitzmiller, University of Illinois, Urbana. 18 pp., 64 refs.; "Feeding Habits of Biting Flies and Their Significance in Classification," by J. A. Downes, Department of Agriculture, Ottawa, Canada. 18 pp., 139 refs.; "Resistance of Plants to Insects," by R. H. Painter, Kansas State College, Manhattan. 34 pp., 198 refs.; "Biological Control of Insect Pests," by C. P. Clausen, University of California, Riverside. 29 pp., 119 refs.; "Biology of Scarabaeidae," by P. O. Ritcher, Oregon State College, Corvallis, 23 pp., 174 refs.; "Insect Eradication Programs," by W. L. Popnam and D. G. Hall, U. S. Department of Agriculture. 19 pp., illus., 9 refs.; "Chemistry and Action of Acaricides," by R. B. March, University of California, Riverside. 21 pp., 151 refs., "Organic Phosphorus Insecticides for Control of Field Crop Insects," by W. A. L. David, Agricultural Research Council, Cambridge, England. 23 pp., 184 refs.; "Insecticides for Control of Adult Diptera," by R. W. Fay and J. W. Kilpatrick, U. S. Public Health Service, Savannah, Georgia. 19 pp., 153 refs.; "Forage Insects and Their Control," by G. G. Gyrisco, Cornell University, Ithaca, N. Y. 27 pp., 285 refs.; "Control of Forest Insects," by R. E. Balch, Forest Biology Laboratory, New Brunswick, Canada, 19 pp., 134 refs.; and "Transmission of Plant Viruses by Arthropods," by K. M. Smith, Agricultural Research Council, Cambridge, England. 13 pp., 62 refs.

It will be noted that each paper has been accompanied by an appropriate bibliography (but regrettably with titles of many cited references omitted), these varying from 9 to 285 titles each, with a total of 2807 or an average of 122 titles. Author and subject indexes to the entire volume, making an additional 37 pages, also are included. It is regretted that space limitations here forbid even brief discussion of each of the 23 papers making up this book. It is, however, perhaps enough to state that on the whole, this, in all probability, along with the other two volumes of the series, previously issued, makes up one of the most important and certainly one of the most useful general reference works to appear in a long time. It is a pleasure to commend this latest volume to the attention of entomological fellow workers everywhere. The series "will be extremely helpful in improving the position of entomology as a growing science of the first rank."

J. S. WADE

INSECT FLIGHT, by J. W. S. Pringle. Cambridge, The University Press, VIII + 132 pp., 52 figs., 1957. (Price $3.00, Bentley House, American Branch, 32 East 57th St., New York 22.)

In this small volume we have a synthesis of the muscular, physiological, nervous, and sensory adaptations of insects to the aerodynamics of flight. The text will not all be easy reading for the ordinary entomologist whose chief interest is the taxonomic value of the external characters of insects. Anatomy has long been recognized as an essential part of entomology, and in recent years we have gradually been educated in insect physiology; now we must make the extra effort to grasp the principles of aerodynamics. Inasmuch as almost the whole organization of a flying insect is, one way or another, an adaptation to flight, it would appear that aerodynamics is actually basic for understanding insect structure and why an insect differs from its non-flying arthropod relatives. The text of the book gives a full review of the experimental results and opinions of other investigators of the mechanics of insect flight. The subject matter as presented by Pringle differs little from Chadwick's discussion of insect flight in Roeder's Insect Physiology, which fact will be reassurring to the student, who often finds that "authorities" disagree.

Chapter 1 gives a brief account of the anatomy of the thorax, the wing articulation, and the flight muscles characteristic of the *indirect* type of flight mechanism, in which the wings are moved by vibrations of the wing-bearing notal plates, produced by vertical lateral muscles and longitudinal dorsal muscles. This type of wing mecha-

nism is that of most flying insects, excepting the Odonata and Blattopteroidea.

Chapter 2 treats of the form and mechanics of the wing beat, illustrated by diagrams of the action of the indirect flight muscles and the position of the wings while the insect is flying. The mechanism of the wings is specifically described for several of the principal orders of insects, including the Odonata.

Chapter 3 deals with the histology, physiology, and biochemistry of the flight muscles, with illustrations of the different structural types of insect muscles. Special attention is given to the "fibrillar" type of muscle characteristic of muscles capable of a high rate of contraction, as particularly developed in Coleoptera, Hymenoptera, and Diptera. In these muscles the fibrils are greatly enlarged and separated by spaces containing numerous large mitochondrial bodies known as sarcosomes, which are physiologically related to the intensive oxidation required by the rapidly vibrating flight muscles.

Chapter 4 is devoted to aerodynamics, a subject in which few entomologists are conversant, and for whom the expression of abstract facts in mathematical terms and formulae will be somewhat difficult to understand. The author says, however, that "there is at present no simplified picture of the mechanism of insect flight, which can be used to derive a mathematical theory of the way lift and thrust are generated by wing motion."

Chapter 5 discusses the nervous and sensory mechanisms of insect flight, including innervation of the flight muscles, sense organs of the wings, the role of leg contact with a support in initiating and maintaining flight, the maintenance of stability, the function of the halteres as stabilizers of flight, and the head as an organ of balance.

The insects, presumably without intelligence or the ability to consciously adjust and control their actions, are nevertheless the most efficient of all flying machines. To entomologists accustomed to studying dead insects on pins, an understanding of the complexities of their automatic adaptations to the function of flight will reveal the live insect as probably the most marvelous of all animal mechanisms that evolution has yet produced.

R. E. SNODGRASS

AN INTRODUCTION TO GENETIC STATISTICS. By Oscar Kempthorne. xvii + 545 pages. John Wiley and Sons Inc., New York. 1957. $12.75.

The mathematical theory of genetics has undergone an immense growth in the last 40 years, yet up to this time there has been no single book which has attempted to deal with mathematical and statistical genetics in a comprehensive way. Professor Kempthorne's work is a synthesis of most of the important knowledge in this field, and while the book is not meant to be encyclopedic there are very few significant omissions. Whereas the book is intended partly as a text for advanced students (problems are included at the end of each chapter), it is, in fact, a scholarly work quite apart from its pedagogic function. First, there are many demonstrations representing original work of Professor Kempthorne and not published elsewhere. Second, some topics have been given a rather short treatment because they do not coincide with Kempthorne's main research interest. Thus, a geneticist concerned with natural populations will find more of interest in Li's *Population Genetics* than in *An Introduction to Genetic Statistics*. About one-fifth of this book is devoted to population genetics of qualitative characters in random mating populations, while more than one-third is taken up with a discussion of systems of inbreeding and the effect of inbreeding on the genetic and phenotypic constitution of a population. While the plant and animal breeders are greatly concerned with systems of inbreeding, and the problems arising from non-random mating are challenging to a statistician like Professor Kempthorne, they are not of most concern to the student of evolution. Finally, some work is condemned by the author outright, as, for example, Hayman's work which is referred to simply as a "device", presumably because Kempthorne does not judge it to be of any great value. There is considerable difference of opinion about the merits of Hayman's approach to the problem of interaction between genes. The general treatment of the genetics of quantitative characters by Mather and Hayman is in wide use, yet Professor Kempthorne gives it only scant attention. This is not to be taken as a condemnation of the book, but rather it is meant to illustrate the point that *An Introduction to Genetic Statistics* is in part a critical review and not simply a text book.

The book is very difficult to read for the mathematically uninitiated, despite the author's protestations to the contrary. It must be said that Kempthorne is more lucid in his writing than any other statistical or mathematical geneticist dealing with matters on this plane, but the material, no matter how well expounded, remains extraordinarily difficult for a nonspecialist. The vast majority of geneticists lack the mathematical sophistication to understand this book except by the most diligent application. For an entomologist with only a peripheral interest in genetics it is virtually a hopeless task. On the other hand, a student of mathematical and statistical genetics cannot afford to be without a copy of Kempthorne. It is a book that will be difficult to replace in its field.

R. C. LEWONTIN

MICROBIAL ECOLOGY, edited by R. E. O. Williams and C. C. Spicer. Cambridge University Press, Cambridge England. viii + 388 pp. 1957. $6.50.

This is the Seventh Symposium of the Society for General Microbiology and is composed of 17 papers dealing with various facets of microbial ecology prepared for a symposium on this subject in London in April 1957. With one exception, the papers are restricted to the ecology of microorganisms with a few passing references to insects and other higher animals. The final paper by K. M. Smith discusses factors influencing the spread of plant virus by arthropod vectors. Due to the limitation in size of the paper, this discussion is necessarily of a general nature.

The paper by C. L. Duddington entitled, "The Predaceous Fungi," should prove of interest to nematologists as it deals largely with fungi which attack nematodes. The term "predaceous" may prove misleading to those entomologists who are accustomed to the entomological use of the terms "predator" and "parasite". Duddington considers all fungi which attack and consume microscopic animals to be predators even though the "predator" is a passive spore ingested by the host, the size of the host determining whether the fungus is a predator or parasite. The largest host which Duddington considers to be preyed upon by fungi are rotifers and one species of springtail. Most of the material in this paper is also available in more detail in other publications.

While the other papers in this volume do not deal directly with entomological problems, the parallel between microbial ecology and insect ecology is close enough that entomologists may find the discussions stimulating and thought-provoking. Entomologists working in biological control have not hesitated to make use of predator-prey relationship in the Protozoa to evolve theories which might be applied to insect populations.

CLARENCE G. THOMPSON

NEW PUBLICATIONS

A SYNOPSIS OF HYMENOPTEROUS PARASITES OF MALACOSOMA IN CALIFORNIA. (Lepidoptera, Lasiocampidae) by Robert L. Langston. University of California Publications in Entomology Vol. 14, No. 1, pp. 1–50. 1957. University of California Press, Berkeley 4, California. Price $1.00 Paper.

INSECTS OF HAWAII. Volume VI. Ephemeroptera-Neuroptera-Trichoptera by Elwood C. Zimmerman (Honorary Associate, British Museum, Natural History). ix + 209 pages; 105 detailed drawings, sketches, photographs.

University of Hawaii Press, Honolulu 14, Hawaii. Price $4.50.

ADVANCES IN PEST CONTROL RESEARCH. Editor: Robert L. Metcalf, University of California, Citrus Experiment Station, Riverside, California. Interscience Publishers, New York, N. Y.

Volume I. 1957. 6 x 9. 522 pages, 11 illus., 13 tables. $11.00

Volume II. 1958. 6 x 9. In preparation.

Pest control was formerly an empirical art. It is now in process of becoming firmly based on a number of sciences, ranging from insect physiology to the engineering study of sprays. This series brings together the most recent advances in all phases of the complex applied science of pest control.

UNIVERSITY OF KANSAS SCIENCE BULLETIN VOL. XXXVIII.

Part I pp. xiv + 1029 pp. (dedicated to Herbert Barker Hungerford, Editor 1933–1940) December 20, 1956.

Part II pp. 1033–1543, March 20, 1958. University of Kansas Publications, Lawrence, Kansas.

DIE INSEKTIZIDE-CHEMIE, WIRKUNGSWEISE UND TOXIZITÄT by Dr. Werner Perkow VIII + 384 pp. + 16 figures. Dr. Alfred Hüthig Verlag, Heidelberg. 1956.

INSECTICIDE RECOMMENDATIONS OF THE ENTOMOLOGY RESEARCH DIVISION FOR THE CONTROL OF INSECTS ATTACKING CROPS AND LIVESTOCK 1958 SEASON. Agriculture Handbook No. 120 Agricultural Research Service and Federal Extension Service, U. S. Department of Agriculture. February, 1958. 110 pp.

INSECT CONTROL USING LOW COST EQUIPMENT, a text for leaders of smallholders, by Edgar Dresner, Economic Entomologist, U. S. Technical Aid Program, International Cooperation Administration, in collaboration with Abuhaerah and Usman Djama, Agricultural Extension Service, Ministry of Agriculture, Institute for Plant Diseases and Pests, Agricultural Research Station, Bogor, Indonesia. 1957. 195 pp.

4-H ENTOMOLOGY

Members who attended the annual meeting in Memphis will recall the excellent exhibits arranged by Harrold Jones and his committee. They will also remember that 21 of these exhibits were by 4-H club members from various parts of the United States.

An attractive Certificate of Merit has been designed and copies awarded to these 21 exhibitors. We hope that 4-H entomology exhibits may become a regular part of our annual meetings and that our Certificates of Merit will help to encourage potential entomologists.

L. G. Merrill, Jr., of Rutgers University has advised us that David Riewe of 56 Upper Ferry Road, Trenton, New Jersey and a student at Temple University in Philadelphia has been awarded one of the 4-H Entomology Scholarships for 1955. Mr. Riewe started with the original 4-H entomology club in New Jersey in 1953.

RECOMMENDED READING

INSECTS CAN BE FUN by Alvah Peterson appears in *Nature Magazine* Vol. 51 (4): 208–211, April, 1958. Dr. Peterson emphasizes the fact that the study of birds in the United States has enjoyed a large following among people from all walks of life whereas a corresponding enthusiasm on the part of adult amateur naturalists for the study of insects has never materialized in this country although in many other countries thousands of men and women from all walks of life and of all ages are insect enthusiasts Amateur entomologists in foreign countries find it hard to understand why there are so few nonprofessional adults in the United States who are enthusiastic about insects which in total number of species exceeds greatly the combined species of all other animals.

In this article Dr. Peterson has briefly presented some fascinating and unusual facts about some of the interesting insects and tells how to catch and preserve them. More of this type of authentic information about insects should be kept before the public than is now being done in order to stimulate amateur interest in insects. We commend Dr. Peterson for a job well done.

BOARDING HOUSE FOR BUTTERFLIES by Philip Brady. *Nature Magazine* 51(4):188–190, April, 1958. This interesting article is concerned with an insectary named the Scudder-Forbes Butterfly House. It is located on the Drumlin Farm Wildlife Sanctuary near South Lincoln, Mass. The studies at the Butterfly House are being conducted by Miss Ivy L. LeMon along lines similar to the work in the British West Indies by Dr. William Beebe and his associates as reported in the *National Geographic Magazine*. This is a good companion piece to Dr. Peterson's article in the same issue of *Nature Magazine*.

The feature article in the February issue of the *Journal of Agricultural and Food Chemistry* [6(2):98–103, 1958] is entitled, DON'T LET THE INSECTS RULE, by George C. Decker, Principal Scientist of the Illinois Natural History Survey and President of the Entomological Society of America in 1955. Entomologists are indebted to Dr. Decker for this excellent article which is effectively illustrated and stresses the fact that the struggle between man and insects will never end and that insects now nullify the work of more than a million men, or well over 10% of our agricultural labor force. He also points out that while ecological or biological control may be the ideal, the use of pesticides is the only practical weapon now available for combatting most of our injurious insect species and that with all pests controlled, our yields might be doubled. In the final paragraphs it is pointed out that there seems to be little question but that insects will continue to demand tribute of enormous proportions which may through judicious expenditures for research and practical insect control measures, be reduced considerably, but can never be eliminated entirely; also that entomology is not static because insects are highly versatile living organisms and are constantly changing to meet each change in the environment. Therefore, if we are to hold our own in this continuing battle, research must continue undiminished; and if we are to make progress, research must be expanded.

It is regretted that space limitations prevent giving more here about this article which emphasizes the importance of entomology in such an effective manner. We hope that many good articles of this type will appear in various widely circulated scientific and other journals in the days ahead.

CAREER FOR TOMORROW . . . IN SCIENTIFIC FIELDS, by ANTON BERLE. *American Observer*. Vol. 27(26):8, March 24, 1958. This periodical goes to children in secondary schools. The article noted deals briefly with careers in zoological sciences including entomology. It is obvious and pleasant to note that the editors of the *American Observer* have not fallen into the error, prevalent in many periodicals, of equating the words scientist and physical scientist to the exclusion of biological scientist.

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EXHIBITS AT SALT LAKE CITY

By A. D. Hess, *Chairman, Exhibits Committee*

P.O. Box 625, Greeley, Colorado

General Facilities. Excellent exhibit facilities are provided at the Hotel Utah. The exhibit booths will be on the mezzanine floor of the hotel, offering advantages of ready accessibility to the convention rooms. The physical facilities available at the hotel are complete from the standpoint of convenience and economy to the exhibitors. The meeting will open formally at 9 a.m. on Monday, December 1, and close at 4 p.m. on Thursday, December 4.

It is essential, if the exhibition is to be operated with the greatest benefit and profit to exhibitors, that the exhibiting companies study carefully the following information. If the instructions herein outlined are complied with by the exhibitors, difficulties and confusion will be eliminated and the cost of the exhibition will be reduced to a minimum.

Size of Booths and Rates. The sizes and arrangement of the booths available are shown on the hotel floor plan. In addition to the space available in the hotel, arrangements have been made to lease a portion of the parking lot at the Utah Motor Lodge one block west of the hotel for exhibiting sprayers, dusters, and other power equipment. The space available on the parking lot is ten spaces each 10 x 15 feet.

The booths in the hotel include complete booth set-up, and 7 x 44 inch sign. A number of services to exhibitors are included at no additional cost over the rate shown. There will be no charge for tables or chairs required in booths.

Educational Exhibits	NO CHARGE
Commercial Exhibits:	
5′ x 10′ Booth	$100.00
5′ x 12′ Booth	125.00
6′ x 15′ Booth (one only)	175.00
Tractor or Equipment	125.00
10′ x 15′ Area (Parking Lot Space)	100.00

Uniform decorations and displays will be designed and installed by Jim Silver Displays, 110 Herbert Avenue, Salt Lake City 11, Utah. *Watchman service can be provided for a reasonable fee.*

Size and Weight Limitations. There are two methods of access to the mezzanine of the Hotel Utah: (1) The north service entrance via a short ramp to a freight elevator going directly to the mezzanine floor. The entrance to the elevator is 6½ feet high and 4½ feet wide. It has a depth of 4 feet, 8 inches, and a weight limitation of 4,400 pounds; and (2) An outside hydraulic lift on the east side of the hotel, with entry through the Lafayette Room to the mezzanine. This entryway is large enough to accommodate automobiles. The lift is 8½ feet wide and 19½ feet long. The doorways through the Lafayette Room are 11 feet high and 7½ feet wide.

In accordance with City Fire Department regulations, inflammable oils, gases, or other explosives will not be permitted, and only fireproof materials may be used for decorative purposes.

Power Limitations. The hotel will provide one electrical outlet for each booth featuring 110 volts, alternating current, 60 cycles, single phase, the total illumination for each booth being limited to 450 watts. No charge will be made for power outlets or for current used if demands are within these limitations. If additional electrical capacity is required, an extra charge will be made for the cost of labor and material involved in special wiring and must be approved by the building Superintendent.

Storage and Transfers. To facilitate handling, forward exhibit material to Jim Silver Displays, 110 Herbert Avenue, Salt Lake City, Utah. This firm will provide storage and transfer services at reasonable rates.

INSECT PHOTOGRAPHIC SALONS—WHY HAVE THEM?

By Leland R. Brown

Dept. of Entomology

University of California, Los Angeles

At the first annual meeting of the new Entomological Society of America in Los Angeles in 1953—that is, during the administration of Charles E. Palm, himself an ardent insect cinematographer—Arthur C. Smith organized a group for a special afternoon session entitled: "The use of Photography in Entomology." I was asked to be one of the participants in that session. I think the greatest surprise was the large attendance, even though the session was concurrent with three other very interesting sessions. The seats were all filled and people were standing. Since 1953, our national organization has had no similar photographic sessions.

But again in 1956, the enthusiastic Dr. Smith solicited those members in the west known to be interested in this type of activity, and with the submitted photographs, he organized for the Pacific Branch its first photo salon, complete with a judge, ribbon awards, etc. This evening salon program at Berkeley met with such an enthusiastic audience response that the Branch *Resolutions Committee* strongly urged that the succeeding program chairman consider the inclusion of the second salon for the Portland meeting in 1957.

The second Pacific Branch salon was very well organized and carried off quite successfully by the aptly chosen J. C. Chamberlin and C. W. Getzendaner. Dr. Chamberlin and I had the responsibility for the succeeding salon, that is—the third, just this past June in San Diego; and the Branch *Resolutions Committee* has urged that the fourth salon be organized for the 1959 meeting in Sacramento.

In the meantime our Society's president, Dr. Metcalf, and the program chairman, Dr. Anderson, both being pretty fair hands with a camera, urged the writer to "volunteer" (Metcalf is also my boss, you must understand) to run an insect photographic salon for our December 1958 meeting in Salt Lake City. This I agreed to do on the condition that I could share this responsibility with two very capable men: J. C. Chamberlin and William P. Nye. Thus, along with the call for papers, each member received an information sheet and entry blank for the photo salon in Salt Lake City. I hope that all who photograph these small fascinating animals in which we are mutually interested, will seriously consider this invitation to the salon.

By this brief history of insect photographic salons in the western U.S.A., I have tried to pin down the most compelling reason for their existence—which is, the members want them. It might be well to recall what, in effect, a photograph, or for that matter any illustration, is: it is a

means of communication—unique, powerful, rapid—and taking up where language leaves off. Perhaps we all have one trait in common—intense curiosity—the common denominator of scientific groups. Then is it so surprising that a distinctly diverse group of animals such as insects, illustrated by a powerful means of communication before an intently curious group of humans should make these people want more of it? It certainly is not surprising to me. Photographs, like other means of communication such as poetry or scientific writing, vary from poor to excellent. One of the objectives of the salons I have known, is to reward excellence by some form of recognition, such as ribbons and awards. I feel that such competition makes us strive to improve. Also I feel that we, as a group of biologists in this era, should adapt to our use any means that will get our message across strong and clear.

Regarding the Insect Photographic Salon in Salt Lake City, Utah: the deadline for receipt of photographs is Nov. 17, 1958. It is imperative that the instructions on the back of the required Entry Blank be observed, as no photographs should be sent to Salt Lake City (depending on your entry, 3 other receiving points are listed). A category of "Motion Pictures" has been established in addition to the usual still picture categories. I hope each professional entomologist will consider this as a particularly strong invitation to him personally. Any further information will be gladly supplied on request.

MEETINGS

WINNIPEG, MANITOBA. Fort Garry Hotel. September 15–17, 1958. Annual Meeting, Canadian Agricultural Chemicals Association. J. H. Elliott, President, 1005 Sherbrooke St., West, Montreal 2, Quebec.

WASHINGTON, D. C., Statler Hotel. October 20–23, 1958. The Silver Anniversary Convention of the National Pest Control Association. Ralph E. Heal, Executive Secretary, Buettner Memorial Building, 250 West Jersey Street, Elizabeth, New Jersey.

SAVANNAH, GEORGIA. General Oglethorpe Hotel. October 29–31, 1958. The twenty-fifth annual meeting, National Agricultural Chemicals Association. J. V. Vernon, President, Niagara Chemicals Division, Food Machinery and Chemical Corp., Middleport, New York; L. S. Hitchner, Executive Secretary, N.A.C.A., 1145 19th Street, N.W., Washington 6, D. C. (Please note new location).

GUELPH, ONTARIO, CANADA. Ontario Agricultural College. October 29–31, 1958. The eighth annual meeting of the Entomological Society of Canada and the ninety-fifth annual meeting of the Entomological Society of Ontario. G. P. Holland, President of E.S.C., Science Service Bldg., Ottawa, Ontario; G. G. Dustan, President of E.S.O., Entomology Laboratory, Vineland Station, Ontario; W. C. Allan, Secretary of E.S.O., Ontario Agricultural College, Guelph, Ontario.

BALTIMORE, MARYLAND. Lord Baltimore Hotel. November 24–25, 1958. The thirtieth annual meeting, Eastern Branch, Entomological Society of America. Neely Turner, Chairman, Agricultural Experiment Station, New Haven, Connecticut; B. F. Driggers, Secretary-Treasurer, New Jersey Agricultural Experiment Station, New Brunswick, New Jersey.

SALT LAKE CITY, UTAH. Hotel Utah. December 1–4, 1958. The sixth annual meeting of the Entomological Society of America. R. L. Metcalf, President, Citrus Experiment Station, Riverside, California. R. H. Nelson, Executive Secretary, 1530 P Street, N.W., Washington, D. C.

NEW YORK, NEW YORK. Commodore Hotel. December 8–10, 1958. The forty-fifth annual meeting Chemical Specialties Manufacturers Association. H. W. Hamilton, Secretary, C.S.M.A. 50 East 41st Street, New York 17, N. Y.

WASHINGTON, D. C. December 26–30, 1958. The one hundred twenty-fifth annual meeting of the American Association for the Advancement of Science. Dael Wolfle, Executive Officer, AAAS, 1515 Massachusetts Avenue, N.W., Washington 5, D. C.

MEMBERS IN THE NEWS

Honorary Member J. J. DAVIS is Editor of the *Pi Chi Omega Bulletin*—when he is not in Europe. Our P.C.O. members will be interested in this *Bulletin*. The August 15, 1958 issue contained an appreciated boost for this Society.

HOWARD J. GRADY has been elected Executive Vice President and member of the Board of Directors of the California Spray-Chemical Corporation. His headquarters will be in Richmond, California.

RALPH W. SHERMAN is President of the U.S.D.A. Welfare and Recreation Association in Washington, D. C.

J. H. LILLY, formerly of the Department of Zoology and Entomology, Iowa State College, has been named Head of the Department of Entomology and Plant Pathology, Massachusetts State University at Amherst. Experiment station, extension, and teaching activities are all to be centered in the one department.

LLOYD M. BERTHOLF, formerly Academic Vice President of the College of the Pacific at Stockton, California, has been named President of Illinois Wesleyan University at Bloomington.

A. L. STEINHAUER has joined the staff of the Department of Entomology, University of Maryland at College Park.

R. C. BUSHLAND, Kerrville, Texas, and G. W. EDDY, Corvallis, Oregon, U. S. Department of Agriculture were awarded Medals of Merit by the National Hide Association for their research in the field of systemic insecticides in cattle grub control.

HARRY L. PARKER of the U. S. Department of Agriculture, European Parasite Laboratory, has been elected a member of the French Academie d'Agriculture.

JOHN J. FAVINGER has been appointed State Entomologist of Indiana with headquarters at Indianapolis.

E. F. KNIPLING, Director, Entomology Research Division, U.S.D.A. received an Alumni Award of Merit from the Iowa State College Alumni Association for "pre-eminent service in advancing human welfare."

Past-President B. A. PORTER, U. S. Department of Agriculture, received an honorary D.Sc. from his alma mater, Massachusetts State University.

JOHN E. CASIDA, Department of Entomology, University of Wisconsin, is spending a sabbatical year in Europe. R. D. O'BRIEN, Science Service Laboratory, London, Ontario, is Visiting Professor at Wisconsin in Dr. Casida's absence.

P. O. RITCHER, Department of Entomology, Oregon State College, is spending a year in the orient.

DALE F. BRAY has been appointed Chairman of the Department of Entomology, University of Delaware at Newark.

Distinguished members whose pictures have appeared on the back cover of recent issues of *Croplife* are CHARLES L. HOVEY, H. DOUGLAS TATE, and E. H. LITTOOY.

E. J. CAMPAU supervises entomological research at the Lilly Agricultural Research Center, Greenfield, Indiana. F. D. MORRISON is Dr. Campau's assistant.

JOSEPH M. GINSBERG has returned to Rutgers University, New Brunswick, N. J., after two years with the USOM to Israel sponsored by the International Cooperative Administration.

Bible References to Insects and Other Arthropods

By W. G. BRUCE

Animal Disease Eradication Division, Agricultural Research Service,

United States Department of Agriculture, Washington, D. C.

FOREWORD

Perhaps no other single book in the Western World is so frequently cited as the Bible. It is used to point a moral, to adorn a tale, to win an argument, and to title a book. This all-time best seller is also a rich source of quotable material on insects and their relatives—their records of devastation; their use by philosophers to exemplify desirable attributes of industry and humility; their ravages pointed to as retribution for evil-doing.

Before the advent of modern science, the Bible was often used as a bridge of antiquity. Although science is now able to antedate scriptural material, the Bible nevertheless remains a favored source. How could a dry, factual report of an excavation below the walls of Jericho compete with a colorful Near-Eastern poem, proverb, or history, translated into the robust English of Shakespeare's time! For this reason, the quotations given here are from the King James version. The sweep and dignity of its language make up for any inaccuracies modern scholars may have found in its translation.

For ease of reference, the author has listed the books of the Bible alphabetically rather than in the order of their occurrence. Most of us have forgotten their order, if we ever knew it. He has not included references to manna, which some entomologists believe came from a scale insect; this is debatable, so long after the fact. He has also left out references to honey, even though it comes from the bee; it is as divorced from the insect, once removed from the hive, as milk is from a cow when the milking is done. There has to be a point of separation somewhere.

Some may find the verse-by-verse references scanty, away from their context. This can be easily remedied by looking up the original, from the references given.

Any such compilation must have its shortcomings, but the author would not have made this compilation had he not believed that it would be helpful to someone.

Editorial Comment

Index of References

INSECTS AND RELATIVES	NO. OF REFERENCES
Ants	2
Bees	4
Beetles	1
Cankerworms	4
Caterpillars	9
Fleas	2
Flies	9
Gnats	1
Grasshoppers	10
Hornets	3
Lice	4
Locusts	24
Moths	11
Palmerworms	3
Spiders	3
Scorpions	10
Worms	20
Total	120

List of References

Ants—Proverbs 6:6, 30:25

Bees—Deuteronomy 1:44, Isaiah 7:18, Judges 14:8, Psalms 118:12

Beetles—Leviticus 11:22

Cankerworms—Joel 1:4, 2:25; Nahum 3:15

Caterpillars—II Chronicles 6:28; Isaiah 33:4; Jeremiah 15:14, 27; Joel 1:4, 2:25; I Kings 8:37; Psalms 78:46, 105:34

Fleas—I Samuel 24:14, 26:20

Flies—Ecclesiastes 10:1, Exodus, 8:21, 22, 24, 29, 31; Isaiah 7:18; Psalms 78:45, 105:31

Gnats—Matthew 23:24

Grasshoppers—Amos 7:1; Ecclesiastes 12:5; Isaiah 40:22; Jeremiah 46:23; Job 39:20; Judges 6:5; 7:12; Leviticus 11:22; Nahum 3:17; Numbers 13:33

Hornets—Deuteronomy 7:20; Exodus 23:28; Joshua 24:12

Lice—Exodus 8:16, 17, 18; Psalms 105:31

Locusts—II Chronicles 6:28, 7:18; Deuteronomy 28:38, 42; Exodus 10:4, 12, 13, 14, 19; Isaiah 33:4; Joel 1:4, 2:25; I Kings 8:37; Leviticus 11:22; Matthew 3:4; Mark 1:6; Nahum 3:15, 17; Proverbs 30:27; Psalms 78:46, 105:34, 109:23; Revelation 9:3, 7

Moths—Hosea 5:12; Isaiah 50:9, 51:8; James 5:2; Job 4:19, 13:28, 27:18; Luke 12:33; Matthew 6:19, 20; Psalms 39:11

Palmerworm—Amos 4:9; Joel 1:4, 2:25

Spiders—Isaiah 59:5; Job 8:14; Proverbs 30:28

Scorpions—II Chronicles 10:11, 14; Deuteronomy 8:15; Ezekiel 2:6; I Kings 12:11, 14; St. Luke 10:19, 11:12; Revelation 9:3, 10

Worms—The Acts 12:23; Deuteronomy 28:39; Exodus 16:20, 17:24; Isaiah 14:11, 41:14, 51:8, 66:24; Job 7:5, 17:14, 19:26, 21:26, 24:20, 25:6; Jonah 4:7; St. Mark 9:44, 46, 48; Micah 7:17; Psalms 22:6

Quotations

The Acts

12:23—And immediately the angel of the Lord smote him, because he gave not God the glory: and he was eaten by worms, and gave up the ghost.

Amos

4:9—I have smitten you with blasting and mildew: when your gardens and your vineyards and your fig trees and your olive trees increased, the palmerworm devoured them: yet have ye not returned unto me, saith the Lord.

7:1—Thus hath the Lord God shewed unto me; and, behold, he formed grasshoppers in the beginning of the shooting up of the latter growth; and, lo, it was the latter growth after the king's mowings.

II Chronicles

6:28—If there be dearth in the land, if there is pestilence, if there be blasting, or mildew, or locusts, or caterpillars; if their enemies besiege them in the cities of their land; whatsoever sore or whatsoever sickness there be: . . .

7:13—If I shut up heaven that there be no rain, or if I command the locusts to devour the

II Chronicles (Continued)

land, or if I send pestilence among my people; . . .

10:11—For whereas my father put a heavy yoke upon you, I will put more to your yoke: my father chastised you with whips, but I will chastise you with scorpions.

10:14—And answered them after the advice of the young men, saying, My father made your yoke heavy, but I will add thereto: my father chastised you with whips, but I will chastise you with scorpions.

Deuteronomy

1:44—And the Amorites, which dwelt in that mountain, came out against you, as bees do, and chased you, and destroyed you in Seir, even unto Hormah.

7:20—Moreover the Lord Thy God will send the hornet among them until they that are left, and hide themselves from thee, be destroyed.

8:15—Who led thee through that great and terrible wilderness, wherein were fiery serpents, and scorpions, and drought, where there was no water; who brought thee forth water out of the rock of flint.

28:38—Thou shalt carry much seed out into the field, and shalt gather but little in; for the locust shall consume it.

28:39—Thou shalt plant vineyards, and dress them, but shalt neither drink of the wine, nor gather the grapes; for the worms shall eat them.

28:42—All thy trees and fruit of thy land shall the locust consume.

Ecclesiastes

10:1—Dead flies cause the ointment of the apothecary to send forth a stinking savour; so doth a little folly him that is in reputation for wisdom and honour.

12:5—Also when they shall be afraid of that which is high, and fears shall be in the way, and the almond tree shall flourish, and the grasshopper shall be a burden, and desire shall fail; because man goeth to his long home, and the mourners go about the streets;

Exodus

8:16—And the Lord said unto Moses, Say unto Aaron, Stretch out thy rod, and smite the dust of the land, that it may become lice throughout all the land of Egypt.

8:17—And they did so; for Aaron stretched out his hand with his rod, and smote the dust of the earth, and it became lice in man, and in beast; all the dust of the land became lice throughout all the land of Egypt.

8:18—And the magicians did so with their enchantments to bring forth lice, but they could not: so there were lice upon man, and upon beast.

8:21—Else if thou wilt not let my people go, behold I will send swarms of flies upon thee, and upon thy servants, and upon thy people, and into thy houses: and the houses of the Egyptians shall be full of swarms of flies, and also the ground whereon they are.

8:22—And I will sever in that day the land of Goshen, in which thy people dwell, that no swarms of flies will be there; to the end thou mayest know that I am the Lord in the midst of the earth.

8:24—And the Lord did so; and there came a grievous swarm of flies into the house of Pharaoh, and into his servants' houses, and into all the land of Egypt: the land was corrupted by reason of the swarm of flies.

8:29—And Moses said, Behold, I go out from thee, and I will intreat the Lord that the swarms of flies may depart from Pharaoh, from his servants, and from his people, tomorrow: but let not Pharaoh deal deceitfully any more in not letting the people go to sacrifice to the Lord.

8:31—And the Lord did according to the word of Moses; and he removed the swarms of flies from Pharaoh, from his servants, and from his people; there remained not one.

10:4—Else, if thou refuse to let my people go, behold, tomorrow will I bring the locusts into thy coast.

10:12—And the Lord said unto Moses, Stretch out thine hand over the land of Egypt for the locusts, that they may come up upon the land of Egypt, and eat every herb of the land, even all that the hail hath left.

10:13—And Moses stretched forth his rod over the the land of Egypt, and the Lord brought an east wind upon the land all that day, and all that night; and when it was morning, the east wind had brought the locusts.

10:14—And the locusts went up over all the land of Egypt: and rested in all the coasts of Egypt; very grievous were they; before them were no such locusts as they, Neither after them shall be such.

10:15—For they (the locusts) covered the face of the whole earth, so that the land was darkened; and they did eat every herb of the land, and all the fruit of the trees which the hail had left: and there remained not any green thing in the trees, or in the herbs of the field, through the land of Egypt.

10:19—And the Lord turned a mighty strong west wind, which took away the locusts, and cast them into the Red Sea; there remained not one locust in all the coasts of Egypt.

16:20—Notwithstanding they harkened not unto Moses; but some of them left of it (manna) until the morning, and it bred worms, and stank: and Moses was wroth with them.

16:24—And they laid it up till the morning, as Moses bade: and it did not stink, neither was there any worm therein.

23:28—And I will send hornets before thee, which shall drive out the Hivite, the Canaanite, the Hittite, from before thee.

Ezekiel

2:6—And thou, son of man, be not afraid of them, neither be afraid of their words, though briers and thorns be with thee, and thou dost dewll among scorpions: be not afraid of their words, nor be dismayed at their looks, though they be a rebellious house.

Hosea

5:12—Therefore will I be unto Ephraim as a moth, and to the house of Judah as rottenness.

Isaiah

7:18—And it shall come to pass in that day, that the Lord shall hiss for the fly that is in the uttermost part of the rivers of Egypt, and for the bee that is in the land of Assyria.

14:11—Thy pomp is brought down to the grave, and the noise of thy viols: the worm is

spread under thee, and the worms cover thee.

33:4—And your spoil shall be gathered like the gathering of the caterpillar; as the running to and fro of locusts shall he run upon them.

40:22—It is He (God) that sitteth upon the circle of the earth, and the inhabitants thereof are as grasshoppers; that stretcheth out the Heavens as a curtain, and spreadeth them out as a tent to dwell in:

41:14—Fear not, thou worm Jacob, and ye men of Israel; I will help thee, saith the Lord, and thy redeemer, the Holy One of Israel.

50:9—Behold, the Lord God will help me; who is he that shall condemn me? Lo, they all shall wax old as a garment; the moth shall eat them up.

51:8—For the moth shall eat them up like a garment, and the worm shall eat them up like wool; but my righteousness shall be for ever, and my salvation from generation to generation.

59:5—They hatch cockatrice eggs, and weave the spider's web; he that eateth of their eggs dieth, and he that which is crushed breaketh out into a viper.

66:24—And they shall go forth, and look upon the carcasses of men that have transgressed against me: for their worm shall not die, neither shall their fire be quenched; and they shall be an abhorring unto all flesh.

James

5:2—Your riches are corrupted, and your garments are motheaten.

Jeremiah

46:23—They shall cut down her forest, saith the Lord, though it cannot be searched; because they are more than the grasshoppers, and are innumerable.

51:14—The Lord of hosts hath sworn by himself, saying, Surely I will fill thee with men, as with caterpillars; and they shall lift up a shout against thee.

51:27—Set ye up a standard in the land, blow the trumpet among the nations, prepare the nations against her, call together against her the kingdoms of Ararat, Minni, and Ashchenaz; appoint a captain against her; cause the horses to come up as the rough caterpillars.

Job

4:19—How much less in them that dwell in houses of clay, whose foundation is in the dust, which are crushed before the moth.

7:5—My flesh is clothed with worms and clods of dust; my skin is broken, and become loathsome.

8:14—Whose (the hypocrites) hope shall be cut off, and whose trust shall be a spider's web.

13:28—And he, as a rotten thing, consumeth, as a garment that is motheaten.

17:14—I have said to corruption, Thou art my father; to the worm, Thou art my mother, and my sister.

19:26—And though after my skin worms destroy this body, yet in my flesh shall I see God:

21:26—They shall lie down alike in the dust, and the worms shall cover them.

24:20—The womb shall forget him; the worm shall feed sweetly on him; he shall be no more remembered; and wickedness shall be broken as a tree.

25:6—How much less man, that is a worm? and the son of man, which is a worm.

27:18—He buildeth his house as a moth, and as a booth that the keeper marketh.

39:20—Canst thou make him (the horse) afraid as a grasshopper? the glory of his nostrils is terrible.

Joel

1:4—That which the palmerworm hath left hath the locust eaten; and that which the locust hath left hath the cankerworm eaten; and that which the cankerworm hath left hath the caterpillar eaten.

2:25—And I will restore to you the years that the locust hath eaten, the cankerworm, and the caterpillar, and the palmerworm, my great army which I sent among you.

Jonah

4:7—But God prepared a worm when the morning rose the next day, and it smote the gourd that it withered.

Joshua

24:12—And I sent the hornet before you, which drave them out from before you, even the two kings of the Amorites; but not with thy sword nor with thy bow.

Judges

6:5—For they came up with their cattle and their tents, and they came as grasshoppers for multitude; for both they and their camels were without number: and they entered into the land to destroy it.

7:12—And the Midianites and the Amalekites and all the children of the east lay along in the valley like grasshoppers for multitude; and their camels were without number, as the sand by the seaside for multitude.

14:8—And after a time he (Sampson) returneth to take her (a wife), and he turned aside to see the carcass of the lion: and, behold, there was a swarm of bees and honey in the carcass of the lion.

I Kings

8:37—If there be in the land famine, if there be pestilence, blasting, mildew, locust, or if there be caterpillar; if their enemy besiege them in the land of their cities; whatsoever plague, whatsoever sickness there be;

12:11—And now whereas my father did lade you with a heavy yoke, I will add to your yoke; my father hath chastised you with whips, but I will chastise you with scorpions.

12:14—And spake to them after the counsel of the young men, saying, My father made your yoke heavy, and I will add to your yoke; my father also chastised you with whips, but I will chastise you with scorpions.

Leviticus

11:22—Even these of them ye may eat; the locust after his kind, and the bald locust after his kind, and the beetle after his kind, and the grasshopper after his kind.

Luke

10:19—Behold, I give unto you power to tread on serpents and scorpions, and over all the power of the enemy; and nothing shall by any means hurt you.

11:12—Or if he shall ask an egg, will he offer him a scorpion?

12:33—Sell that ye have, and give alms; provide yourselves with bags which wax not old, a treasure in the heavens that faileth not,

Luke (Continued)

where no thief approacheth, neither moth corruptetb.

Mark

1:6—And John was clothed with camel's hair; and with a girdle of skin about his loins; and he did eat locusts and wild honey.

9:44—Where their worm dieth not, and the fire is not quenched.

9:46—Where their worm dieth not, and the fire is not quenched.

9:48—Where their worm dieth not, and the fire is not quenched.

Matthew

3:4—And the same John had his raiment of camel's hair, and a leathery girdle about his loins; and his meat was locusts and wild honey.

6:19—Lay not up for yourselves treasures upon earth, where moth and rust doth corrupt, and where thieves break through and steal.

6:20—But lay up for yourselves treasures in heaven, where neither moth nor rust doth corrupt, and where thieves do not break through nor steal.

23:24—Ye blind guides, which strain at a gnat, and swallow a camel.

Micah

7:17—They shall lick the dust like a serpent, they shall move out of their holes like worms of the earth: they shall be afraid of the Lord our God, and shall fear because of thee.

Nahum

3:15—There shall the fire devour thee; the sword shall cut thee off, it shall eat thee up like the cankerworm: make thyself many as the cankerworms, make thyself many as the locusts.

3:16—Thou hast multiplied thy merchants above the stars of heaven: the cankerworm spoileth, and fleeth away.

3:17—Thy crowned are as the locusts, and thy captains as the great grasshoppers, which camp in the hedges in the cold day, but when the sun ariseth they flee away, and their place is not known where they are.

Numbers

13:33—And there we saw the giants, the sons of Anak, which come of the giants: and we were in our own sight as grasshoppers, and so we were in their sight.

Proverbs

6:6—Go to the ant thou sluggard; consider her ways, and be wise.

30:25—The ants are a people not strong, yet they prepare their meat in the summer.

30:27—The locusts have no king, yet go they forth all of them by bands;

30:28—The spider taketh hold with her hands, and is in kings' palaces.

Psalms

22:6—But I am a worm, and no man; a reproach of men, and despised of the people.

39:11—When thou with rebukes dost correct man for iniquity, thou makest his beauty to consume away like a moth: surely every man is vanity.

78:45—He sent divers sorts of flies among them, which devoured them; and frogs, which destroyed them.

78:46—He gave also their increase unto the caterpillar, and their labour unto the locust.

105:31—He spake, and there came divers sorts of flies and lice in all their coasts.

105:34—He spake and the locusts came, and caterpillars, and that without number.

105:35—And (locusts and grasshoppers) did eat up all the herbs in their land, and devoured the fruit of their ground.

109:23—I am gone like the shadow when it declineth: I am tossed up and down as the locust.

118:12—They compassed me about like bees; they are quenched as the fire of thorns: for in the name of the Lord I will destroy them.

Revelation

9:3—And there came out of the smoke locusts upon the earth; and unto them was given power, as the scorpions of the earth have power.

9:7—And the shapes of the locusts were like unto horses prepared unto battle; and on their heads were as it were crowns like gold, and their faces were as the faces of men.

9:10—And they had tails like unto scorpions, and there were stings in their tails: and their power was to hurt men five months.

I Samuel

24:14—After whom is the King of Israel come out? After whom dost thou pursue? After a dead dog, after a flea.

26:20—Now therefore, let not my blood fall to the earth before the face of the Lord: For the King of Israel is come out to seek a flea, as when one doth hunt a partridge in the mountain.

PACIFIC BRANCH MEETING

The forty-second annual meeting of the Pacific Branch of the Entomological Society of America was held at the El Cortez Hotel in San Diego, California, on June 25–27, 1958. The meeting was well planned, well attended, and well conducted. The new officers of this Branch are listed below. The 1958 officers were listed on page 33 of the March 1958 BULLETIN.

L. M. Smith, Davis, California.....*Chairman*
H. C. Manis, Moscow, Idaho.....*Chairman-Elect*
H. H. Keifer, Sacramento, California..*Secretary-Treasurer*

INTERNATIONAL CONGRESS OF ENTOMOLOGY

The XIth International Congress of Entomology will be held in Vienna, Austria, August 17–25, 1960. Preliminary information has been sent out by Dr. Max Beier, the general secretary. We hope that many entomologists from this side of the Atlantic will begin making plans to attend. For further details please write to the following. They would like to hear from prospective attendants prior to December 31, 1958.

An das Secretariate des
XI Internationalen Entomologen Kongresses
Wein 1,
Burgring (Naturhistorisches Museum)
Austria

The office of the Executive Secretary in Washington will recommend a travel agency to members or groups of members of the Entomological Society of America who wish such assistance in planning their trip to Austria.